

***Wisconsin***  
***Chapter HFS 157 -Radiation Protection***  
***Regulatory Guide***  
**July, 2003**

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**Guidance for Industrial Radiography Use**

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**PPH 45045 (07/03)**



## EXECUTIVE SUMMARY

Wisconsin Regulatory Guides (WISREGS) are issued to describe and make available to the applicant or licensee, acceptable methods of implementing specific parts of **Wisconsin Administrative Code, Chapter HFS 157 ‘Radiation Protection’**, to delineate techniques used by the Department of Health and Family Services (DHFS) staff in evaluating past specific problems or postulated accidents, and to provide guidance to applicants, licensees. WISREGS are not substitutes for **Chapter HFS 157 ‘Radiation Protection’**, therefore compliance with them is not required. Methods and solutions different from those set forth in this guide will be acceptable if they provide a basis for the DHFS, Radiation Protection Section to determine if a radiation protection program meets the current rule and protects health and safety.

Comments and suggestions for improvements in this WISREG are encouraged. This WISREG will be revised, as appropriate, to accommodate comments and to reflect new information or experience. Comments should be sent to **Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison, WI 53701-2659**.

To request copies of this guide (which may be reproduced) call DHFS, Radiation Protection Section at (608) 267-4797 or for electronic copy go to our web site at:

[http://dhfs.wisconsin.gov/dph\\_beh/RadioactiveMat/IndexRM.htm](http://dhfs.wisconsin.gov/dph_beh/RadioactiveMat/IndexRM.htm).

This WISREG ‘Guidance for Industrial Radiography Use’ has been developed to streamline the application process for an industrial radiography license. A copy of the application DPH form 45013, ‘*Application for a Radioactive Material License Authorizing the use of Industrial Radiography*’ is located in **Appendix A** of this guide.

**Appendix C through P** provide examples, models and additional information that can be used when completing the application.

It typically takes 60-90 days for a license to be processed and issued if the application is complete. When submitting the application be sure to include the appropriate application fee listed in **HFS 157.10** for an industrial radiography license.

In summary, the applicant will need to perform the following for submitting an industrial radiography license application:

- Use this regulatory guide to prepare the application, DPH form 45013, '*Application for a Radioactive Material License Authorizing the use of Industrial Radiography*' (**Appendix A**).
- Complete the application, DPH form 45013, '*Application for a Radioactive Material License Authorizing the use of Industrial Radiography*' (**Appendix A**). See 'Contents of Application' of the guide for additional information.
- Include any additional attachments:
  - All supplemental pages should be on 8 ½" x 11" paper,
  - Please identify all attachments with the applicant's name and license number (if a renewal);
- Avoid submitting proprietary information unless it is absolutely necessary;
- Submit an original signed application along with attachments (if any) and if possible a copy on a diskette or CD (Microsoft Word is preferred);
- Submit the application fee; and
- Retain one copy of the licensee application and attachments (if any) for your future reference. You will need this information because the license will require that radioactive material be possessed and used in accordance with statements, representation, and procedures provided in the application and supporting documentation.

If you have any questions about the application process please contact DHFS, Radiation Protection Section at (608) 267-4797.

# CONTENTS

Executive Summary .....	2
Contents.....	4
List of Tables .....	5
List of Figures .....	5
List of Appendices .....	6
Abbreviations .....	7
Purpose of WISREG .....	8
Who Regulates at Federal Facilities in Wisconsin .....	10
Management Responsibility .....	12
Applicable Rule .....	13
How to File .....	14
Where to File .....	15
License Fees .....	16
<b>Contents of Application</b>	
Item 1. Type of Application .....	17
Item 2 Name and Mailing Address of Applicant .....	17
Item 3. Person to Contact Regarding Application .....	19
Item 4. Location of Radioactive Material .....	20
<b>Radiation Safety Officer, Radiographers and Radiographer’s Assistants</b>	
Item 5 Radiation Safety Officer (RSO).....	21
Item 6 Training For Radiographers and Radiographer’s Assistants .....	24
<b>Radioactive Material</b>	
Item 7 Radioactive Material .....	27
Item 8 Financial Assurance and Recordkeeping for Decommissioning .....	30
<b>Facilities and Equipment</b>	
Item 9 Facilities and Equipment.....	32
<b>Radiation Safety Program</b>	
Item 10 Radiation Safety Program .....	37
Item 10.1 Radiation Safety Program Audit .....	38
Item 10.2 Termination of Activities .....	39
Item 10.3 Instruments .....	40
Item 10.4 Material Receipt and Accountability .....	41
Item 10.5 Leak Tests .....	43
Item 10.6 Occupational Dosimetry .....	44
Item 10.7 Public Dose .....	46
Item 10.8 Quarterly Maintenance .....	48
Item 10.9 Operating and Emergency Procedures .....	49
Item 10.9.1 Handling and Use of Sealed Sources and Radiography Exposure Devices .....	50
Item 10.9.2 Methods and Occasions for Conducting Radiation Survey .....	51
Item 10.9.3 Methods for Controlling Access to Radiographic Areas .....	53
Item 10.9.4 Methods and Occasions for Locking and Securing Radiographic Exposure Devices, Storage Containers, and Sealed Sources .....	57
Item 10.9.5 Personnel Monitoring and the Use of Personnel Monitoring Equipment .....	58
Item 10.9.6 Transporting Sealed Sources to Field Locations, Securing Exposure Devices and Storage Containers in Vehicles, Posting Vehicles, and Controlling Sealed Sources During Transportation .....	60
Item 10.9.7 Daily Inspection and Maintenance of Radiographic Equipment .....	63
Item 10.9.8 Ratemeter Alarms or Off-Scale Dosimeter Readings .....	64

Item 10.9.9 Procedure for Identifying and Reporting Defects and Non-Compliance .....	65
Item 10.9.10 Notification of Proper Persons in the Event of an Accident .....	66
Item 10.9.11 Minimizing Exposure of Persons in the Event of an Accident .....	68
Item 10.9.12 Source Retrieval .....	70
Item 10.9.13 Maintenance of Records .....	71
Item 10.10 Minimization of Contamination .....	72
Item 11 Waste Management .....	73
<b>Fees and Certification</b>	
Item 12 License Fees .....	74
Item 13 Certification .....	74
Appendices .....	76

## TABLES

<b>Table 1</b>	Who Regulates the Activity.....	10
<b>Table 2</b>	Industrial Nuclear Model Ir-100 Exposure Maximum Authorization – 120 Ci.....	29
<b>Table 3</b>	Spec Model 150 Exposure Device Maximum Authorization – 150 Ci.....	29
<b>Table 4</b>	Amersham Model 680 System Exposure Device Maximum Authorization – 110 Ci.....	29
<b>Table 5</b>	Amersham Model 660 System Exposure Device Maximum Authorization – 140 Ci.....	30
<b>Table 6</b>	Surveys Required for Radiographic Operations.....	52
<b>Table 7</b>	Notification in the Event of an Accident.....	66
<b>Table 8</b>	Information Known About Each Device .....	118
<b>Table 9</b>	Calculation Method, Part 1: Hourly and Annual Dose Received from Device 1 .....	119
<b>Table 10</b>	Calculation Method, Part 1: Hourly and Annual Dose Received from Device 2 .....	119
<b>Table 11</b>	Calculation Method, Part 1: Total Hourly and Annual Dose Received from Devices 1 and 2 .....	120
<b>Table 12</b>	Calculation Method, Part 2: Annual Dose Received from Devices 1 and 2 .....	120
<b>Table 13</b>	Calculation Method, Part 3: Summary of Information .....	121
<b>Table 14</b>	Calculation Method, Part 3: Annual Dose Received from Devices 1 and 2 .....	122
<b>Table 15</b>	Half Value Layers (HVL) for Typical Shielding Materials .....	122
<b>Table 16</b>	Calculation Method, Part 4: Annual Dose Received from Devices 1 and 2 .....	123
<b>Table 17</b>	Combination Measurement – Calculational Method .....	125

## FIGURES

<b>Figure 1</b>	U.S. Map Location of NRC Offices and Agreement States.....	11
<b>Figure 2</b>	RSO Responsibilities.....	23
<b>Figure 3</b>	Diagram of a Permanent Radiography Installation.....	34
<b>Figure 4</b>	Material Receipt and Accountability .....	42
<b>Figure 5</b>	Dose Limits .....	44
<b>Figure 6</b>	Storing Devices .....	47
<b>Figure 7</b>	Posting.....	54
<b>Figure 8</b>	Surveillance and Posting at a Temporary Job Site with Multiple Floors and Access Points.....	55
<b>Figure 9</b>	Security.....	58
<b>Figure 10</b>	The Well Dressed Radiographer.....	59
<b>Figure 11</b>	Transportation .....	60
<b>Figure 12</b>	Emergency Procedures.....	68
<b>Figure 13</b>	Diagram of Offices and Devices Storage Area .....	118

## APPENDICES

<b>Appendix A</b>	DPH Form 45013, ‘ <i>Application for a Radioactive Material License Authorizing the use of Industrial Radiography</i> ’ .....	76
<b>Appendix B</b>	DPH Form 45007, ‘ <i>Certificate of Disposition of Material</i> ’ .....	78
<b>Appendix C</b>	Reserved .....	79
<b>Appendix D</b>	Reserved .....	80
<b>Appendix E</b>	Information Needed for Change of Ownership or Control Application .....	81
<b>Appendix F</b>	NRC Information Notice (IN) 96-20, ‘Demonstration of Associated Equipment Compliance with 10 CFR 34.20’ .....	84
<b>Appendix G</b>	Radiographer and Radiographer’s Assistant Training .....	93
<b>Appendix H</b>	Six-Month Radiographer/Radiographer’s Assistant Inspection Checklist .....	97
<b>Appendix I</b>	Radiation Protection Program Audit .....	99
<b>Appendix J</b>	Procedure for Calibrating Survey Instruments .....	109
<b>Appendix K</b>	Requests to Perform Leak Testing and Sample Analysis .....	112
<b>Appendix L</b>	Guidance for Demonstrating That Individual Members of the Public Will Not Receive Doses Exceeding the Allowable Limits .....	115
<b>Appendix M</b>	Information for Applicants to Consider When Developing Procedures for Operating Radiography Equipment .....	126
<b>Appendix N</b>	Transportation .....	129
<b>Appendix O</b>	Daily Maintenance Check of Radiographic Equipment .....	140
<b>Appendix P</b>	Suggested Example of a Routine Emergency Procedure .....	143

## ABBREVIATION

ALARA	As low as reasonably is achievable
ANSI	American National Standards Institute
Bq	Becquerel
BPR	Business Process Redesign
CFR	Code of Federal Regulations
Cm	Centimeter
COC	Certificate of Compliance
DHFS	Wisconsin Department of Health and Family Services
DOE	United States Department of Energy
DOT	United States Department of Transportation
DU	Depleted uranium
GPO	Government Printing Office
Hr	Hour
IN	Information Notice
Mrem	Millirem
MSv	Millisievert
NARM	Naturally-occurring and Accelerator-produced Radioactive Material
NIST	National Institute of Standards and Technology
NMSS	Office of Nuclear Materials Safety and Safeguards
NRC	United States Nuclear Regulatory Commission
NVLAP	National Voluntary Laboratory Accreditation Program
OC	Office of the Controller
OCR	Optical character reader
OMB	Office of Management and Budget
OSP	Office of State Programs
RPS	Radiation Protection Section
RQ	Reportable quantities
RSO	Radiation Safety Officer
SI	International System of Units(abbreviated SI from the French Le Systeme Internationale d'Unites)
SSD	Sealed Source and Device
Sv	Sievert
TEDE	Total effective dose equivalent
TI	Transportation Index
TLD	Thermoluminescent dosimeters
URL	Uniform Resource Locator



## PURPOSE OF WISREG

This WISREG provides guidance to an applicant in preparing an industrial radiography license application as well as criteria for evaluating a radiography license application. The term "radiography" as used in this guide means an examination of the structure of materials by nondestructive methods, using ionizing radiation to make radiographic images generally using gamma-emitting radioactive materials (radioisotopes). The radioisotopes most commonly used for radiography are cobalt-60 and iridium-192; however, other radioisotopes (e.g. californium-252) with unique radiological characteristics may also be used. This WISREG does not address the research and development of radiography devices or associated equipment, or the commercial aspects of manufacturing, distribution, and service of such devices or equipment.

This WISREG identifies the information needed to complete DPH form 45013, *'Application for a Radioactive Material License Authorizing the use of Industrial Radiography'*. (**Appendix A**),

**Chapter HFS 157 'Radiation Protection'** requires the applicant and/or licensee to develop, document, and implement procedures that will ensure compliance with the rule. Each applicant should read the rule and procedures carefully and then decide if the procedure addresses specific radiation protection program needs at the applicant's facility. Applicants may adopt a procedure or they may develop their own procedures to comply with the applicable rule.

The format within this guide for each item of technical information is as follows:

- Rule - references the requirements from **Chapter HFS 157 'Radiation Protection'** applicable to the item;
- Criteria - outlines the criteria used to judge the adequacy of the applicant's response;
- Discussion - provides additional information on the topic sufficient to meet the needs of most readers;
- Response from Applicant - indicates that a written response is required and/or offers the option of an alternative reply, or indicates that no response is needed on that topic during the licensing process.

Notes, boxes, and references are self-explanatory and may not be found for each item on the application. The application does not have sufficient space for applicants to provide full responses on all items. As indicated on the application, the answers to those items are to be provided on separate sheets of paper and submitted with the completed form.

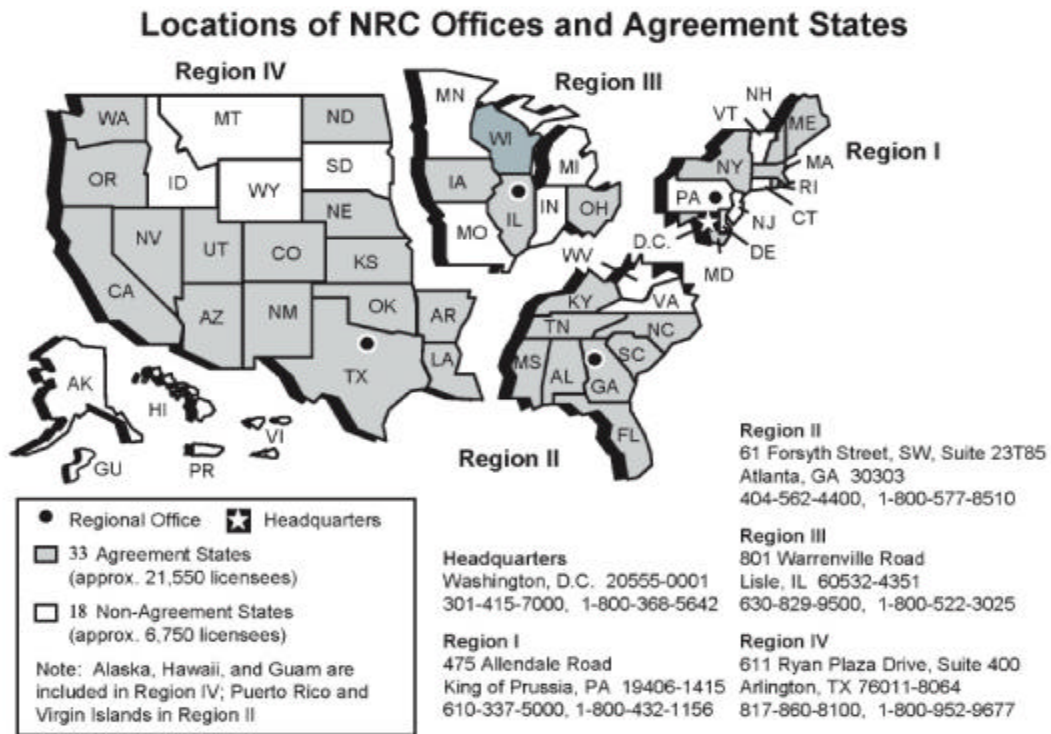
The information submitted in the application must be sufficient to demonstrate that proposed equipment, facilities, personnel, and procedures are adequate to protect the health and safety of the citizens of Wisconsin according to DHFS's guidelines. Submission of incomplete or inadequate information will result in delays in the approval process for the license. Additional information will be requested when necessary to ensure that an adequate radiation safety program has been established. Such requests for additional information will delay completion of the application's review and may be avoided by a thorough study of the rule and these instructions prior to submitting the application.

## WHO REGULATES FACILITIES IN WISCONSIN

In the special situation of work at federally controlled sites in Wisconsin, it is necessary to know the jurisdictional status of the land to determine whether the Nuclear Regulatory Commission (NRC) or DHFS has regulatory authority. The NRC has regulatory authority over land determined to be under “exclusive federal jurisdiction,” while the DHFS has jurisdiction over non-exclusive federal jurisdiction land (see **Table 1**). Applicants and licensees are responsible for finding out, in advance, the jurisdictional status of the specific areas where they plan to conduct licensed operations. DHFS recommends that applicants and licensees ask their local contacts for the federal agency controlling the site (e.g., contract officer, base environmental health officer, district office staff) to help determine the jurisdictional status of the land and to provide the information in writing, so that licensees can comply with DHFS or NRC regulatory requirements, as appropriate. The following table lists examples of regulation authority.

**Table 1: Who Regulates the Activity?**

<b>Applicant and Proposed Location of Work</b>	<b>Regulatory Agency</b>
Federal agency regardless of location (except that Department of Energy [DOE] and, under most circumstances, its prime contractors are exempt from licensing [ <i>10 CFR 30.12</i> ])	NRC
Non-federal entity in non-Agreement State, U.S. territory, or possession	NRC
Non-federal entity in WI at non-federally controlled site	DHFS
Non-federal entity in WI at federally-controlled site <i>not</i> subject to exclusive Federal jurisdiction	DHFS
Non-federal entity in WI at federally-controlled site subject to exclusive federal jurisdiction	NRC



**Figure 1: U.S. Map Location of NRC Offices and Agreement States**

**Reference:** A current list of Agreement States (States that have entered into agreements with the NRC that give them the authority to license and inspect radioactive material used or possessed within their borders), (including names, addresses, and telephone numbers of responsible officials) may be obtained upon request from NRC's Regional Offices. NRC Office of State and Tribal Programs (STP) also provides the current list of Agreement States at web site <http://www.hsr.gov/nrc/home.html>.

## MANAGEMENT RESPONSIBILITY

DHFS recognizes that effective radiation safety program management is vital to achieving safe and compliant operations. DHFS believes that consistent compliance with its rules provides reasonable assurance that licensed activities will be conducted safely. DHFS also believes that effective management will result in increased safety and compliance. DHFS frequently finds ineffective management is the underlying cause of safety and compliance problems.

"Management" refers to the processes for conduct and control of a radiation safety program and to the individuals who are responsible for those processes and who have authority to provide necessary resources to achieve regulatory compliance.

To ensure adequate management involvement, a management representative must be a person duly authorized to act for and on behalf of the applicant or licensee, and must sign the submitted application acknowledging management's commitments and responsibility for the following:

- Ensuring radiation safety, security, control of radioactive materials, and compliance with **Chapter HFS 157 'Radiation Protection'**;
- Ensuring completeness and accuracy of the radiation safety records;
- Knowing the contents of the license and application;
- Committing adequate resources (including space, equipment, personnel, time, and, if needed, contractors) to the radiation protection program to ensure that public and worker safety is protected from radiation hazards;
- Selecting and assigning a qualified individual to serve as the Radiation Safety Officer (RSO), and as necessary, identifying individual(s) as authorized users for their licensed activities;
- Confirming that the RSO has independent authority to stop unsafe operations and will be given sufficient time to fulfill his/her radiation safety duties and responsibilities;
- Ensuring worker audits are conducted at 6-month intervals (may be performed by the RSO);
- Ensuring workers have had adequate training;
- Reporting equipment failures as required under **HFS 157.46**;
- Ensuring current, up-to-date DHFS and United States Department of Transportation (DOT) rules and regulations are available to all employees; and
- Ensuring Operating & Emergency Procedures are available to all employees.

## APPLICABLE RULE

It is the applicant's or licensee's responsibility to obtain, read and follow **Chapter HFS 157 'Radiation Protection'**.

The following subchapters of **Chapter HFS 157 'Radiation Protection'** contain requirements applicable to radiography devices:

- Subchapter I 'General Provisions'
- Subchapter II 'Licensing of Radioactive Materials'
- Subchapter III 'Standards for Protection from Radiation'
- Subchapter IV 'Radiation Safety Requirements for Industrial Radiographic Operations'
- Subchapter X 'Notices, Instructions and Reports to Workers'
- Subchapter XI 'Inspection by the Department'
- Subchapter XII 'Enforcement'
- Subchapter XIII 'Transportation'
- Subchapter XV 'Registration of Radioactive Materials'

To request copies of the above documents, call Department of Health and Family Services (DHFS), Radiation Protection Section at (608) 267-4797 or for electronic copy go to our web site at:

[http://dhfs.wisconsin.gov/dph\\_beh/RadioactiveMat/IndexRM.htm](http://dhfs.wisconsin.gov/dph_beh/RadioactiveMat/IndexRM.htm).

## HOW TO FILE

### PAPER APPLICATION

Applicants for a materials license should do the following:

- Be sure to use the current guidance from DHFS in preparing an application;
- Complete DPH form 45013, '*Application for a Radioactive Material License Authorizing the use of Industrial Radiography*' (**Appendix A**);
- For each separate sheet submitted with the application, identify and key it to the item number on the application, or the topic to which it refers;
- Submit all documents, typed, on 8-1/2 x 11 inch paper;
- Avoid submitting proprietary information unless it is absolutely necessary;
- Submit an original, signed application; and
- Retain one copy of the license application for your future reference.

Deviations from the suggested wording of responses as shown in this WISREG or submission of alternative procedures will require a more detailed review.
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Personal employee information, i.e.; home address, home telephone number, Social Security Number, date of birth and radiation dose information should not be submitted unless specifically requested by DHFS.

## **WHERE TO FILE**

Applicants wishing to possess or use radioactive material in Wisconsin are subject to the requirements of **Chapter HFS 157 ‘Radiation Protection’** and must file a license application with:

*Department of Health and Family Services  
Radiation Protection Section  
P.O. Box 2659  
Madison, WI 53701-2659*



## LICENSE FEES

The appropriate fee must accompany each application or license amendment request. Refer to ***HFS 157.10*** to determine the amount of the fee. DHFS will not issue the new license prior to fee receipt. Once the application review has begun, no fees will be refunded. Application fees will be charged regardless of DHFS's disposition of an application or the withdrawal of an application.

Licensees are also subject to annual fees; refer to ***HFS 157.10***.

Direct all questions about DHFS's fees or completion of **Item 12** of DPH form 45013, '*Application for a Radioactive Material Authorizing the use of Industrial Radiography*' (**Appendix A**) to DHFS, Radiation Protection Section at (608) 267-4797.

## CONTENTS OF APPLICATION

### Item 1: Type of Application

On the application check the appropriate box and list the license number for renewal or amendment.

**Response from Applicant:**

**Item 1 Type Of Application** (Check one box)

☐ New License    ☐ Renewal License Number \_\_\_\_\_ ☐ Amendment License Number \_\_\_\_\_

## Item 2: Name and Mailing Address of Applicant

List the legal name of the applicant's corporation or other legal entity with direct control over use of the radioactive material. A division or department within a legal entity may not be a licensee. An individual may be designated as the applicant only if the individual is acting in a private capacity and the use of the radioactive material is not connected with employment in a corporation or other legal entity. Provide the mailing address where correspondence should be sent.

**Response from Applicant:**

<b>Item 2 Name And Mailing Address Of Applicant:</b>
<b>Applicant's Telephone Number</b> (Include area code):

**Note:** DHFS must be notified in the event of change of ownership or control and bankruptcy proceedings, see below for more details.

## Timely Notification of Change of Ownership or Control

**Rule:** *HFS 157.13(10)*

**Criteria:** Licensees must provide full information and obtain DHFS's written consent prior to transferring control of the license, or, as some licensees call it, "transferring the license".

**Discussion:** Changes in ownership may be the results of mergers, contractual agreements, buyouts, or majority stock transfers. Although it is not DHFS's intent to interfere with the business decisions of licensees, it is necessary for licensees to obtain prior DHFS written consent. This is to ensure the following:

- Radioactive materials are possessed, used, or controlled only by persons who have valid DHFS licenses;
- Materials are properly handled and secured;
- Persons using these materials are competent and committed to implementing appropriate radiological controls;
- A clear chain of custody is established to identify who is responsible for final disposal of radiography devices; and
- Public health and safety are not compromised by the use of such materials.

**Note:** **Appendix E** identifies the information to be provided about transfer of control.

## Notification of Bankruptcy Proceedings

**Rule:** *HFS 157.13(10)*

**Criteria:** *HFS 157.13(10)(e)* states: “A licensee shall notify DHFS in writing within 10 days of filing of a voluntary or involuntary petition for bankruptcy for or against a licensee, the licensee must notify DHFS in writing, identifying the bankruptcy court in which the petition was filed and the date of filing”.

**Discussion:** Even though a licensee may have filed for bankruptcy, the licensee remains responsible for compliance with all regulatory requirements. DHFS needs to know when licensees are in bankruptcy proceedings in order to determine whether all licensed material is accounted for and adequately controlled and whether there are any public health and safety concerns (e.g., contaminated facility). DHFS shares the results of its determinations with other entities involved (e.g., trustees) so that health and safety issues can be resolved before bankruptcy actions are completed.

Licensees must notify DHFS within 10 days of the filing of a bankruptcy petition.

### Item 3: Person To Contact Regarding Application

**Criteria:** Identify the individual who can answer questions regarding the application and include their telephone number.

**Discussion:** This is typically the proposed RSO or knowledgeable management official. DHFS will contact this individual if there are any questions about this application.

Notify DHFS if the contact person or telephone number changes. This notice is for “information only” and does not require a license amendment fee.

## Response from Applicant:

<b>Item 3 Person To Contact Regarding Application:</b>
<hr/>
<b>Contact's Telephone Number</b> (Include area code):

## Item 4: Location of Radioactive Material

**Rule:** *HFS 157.13(2), (6); HFS 157.46(3)*

**Criteria:** Applicants must provide a specific address for each location where radioactive material will be used, stored, or dispatched.

**Discussion:** Specify the street address, or other descriptive address (such as on Highway 10, 5 miles east of the intersection of Highway 10 and State Route 234), city and zip code for each permanent storage or use facility and field station. A field station is a location where licensed material may be stored or used, and from which the applicant will dispatch equipment to jobsites. **A Post Office Box address is not acceptable because DHFS needs a specific address to allow a DHFS inspector to find the use and/or storage location.** If devices will NOT be stored at a dispatch site or field station, indicate this. The applicant should indicate whether a location will be used to perform radiographic operations, storage of sources and devices or used and stored. The applicant should indicate if a permanent cell is located at the address.

Obtaining a DHFS license does not relieve a licensee from complying with other applicable federal, state or local regulations (e.g., local zoning requirements for storage locations).
--

## Response from Applicant:

<b>Item 4 Address(es) Where Radioactive Material Will Be</b> (Do not use Post Office Box): (Attach additional pages if necessary)		
<input type="checkbox"/> Used <input type="checkbox"/> Stored <input type="checkbox"/> Used and Stored	Address:  <input type="checkbox"/> Permanent Radiographic Installation	Telephone Number (Include area code):
<input type="checkbox"/> Used <input type="checkbox"/> Stored <input type="checkbox"/> Used and Stored	Address:  <input type="checkbox"/> Permanent Radiographic Installation	Telephone Number (Include area code):
<input type="checkbox"/> Used <input type="checkbox"/> Stored <input type="checkbox"/> Used and Stored	Address:  <input type="checkbox"/> Permanent Radiographic Installation	Telephone Number (Include area code):
Is industrial radiography performed at temporary job sites?: <input type="checkbox"/> Yes <input type="checkbox"/> No		

**Note:** If radiography operations are expected to exceed 180 days at a temporary jobsite, then provide written notification to DHFS prior to exceeding the 180 days (a license amendment is not required).

## ITEM 5: Radiation Safety Officer (RSO)

**Rule:** *HFS 157.13(6); HFS 157.44(2)*

**Criteria:** RSOs and potential designees are responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures, and must have adequate training and experience.

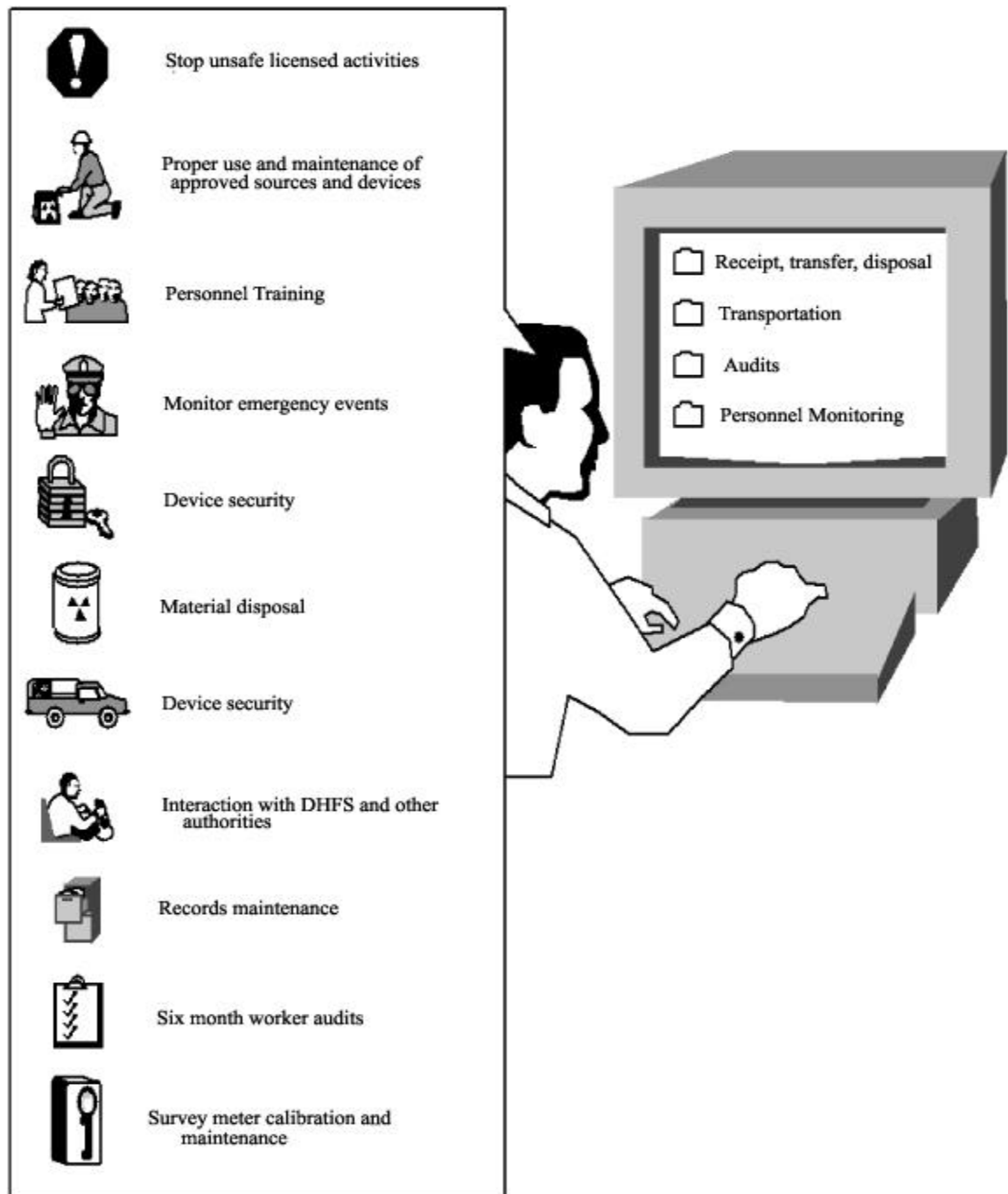
**Discussion:** The person responsible for the radiation protection program is called the RSO. DHFS believes the RSO is the key to overseeing and ensuring safe operation of the licensee's radiography program. The RSO needs independent authority to stop operations that he or she considers unsafe. He or she must have sufficient time and commitment from management to fulfill certain duties and responsibilities to ensure radioactive materials are used in a safe manner.

The RSO may delegate certain day-to-day tasks of the radiation protection program to other responsible individuals (potential designees). For example, a large testing company with multiple field stations may appoint individuals designated as "site RSOs" who assist the RSO and are responsible for the day-to-day activities at the field stations. Licensees may also appoint other individuals who may "step-in" as an emergency contact when the RSO is unavailable. The potential designees do not need to meet the required RSO qualifications; however, these individuals should be qualified, experienced radiographers who are adequately knowledgeable of the activities to which they are assigned. Applicants do not have to identify other responsible individuals if day-to-day tasks, etc. will not be delegated.

Typical RSO duties are illustrated in **Figure 2**. DHFS requires the name of the RSO on the license to ensure that licensee management has identified a responsible, qualified person and that the named individual knows their designation as RSO. Provide DHFS with a copy of an organizational chart showing the RSO and other designated responsible individuals, to demonstrate they have sufficient independence and direct communication with responsible management officials. Also, show in the organizational chart the position of the individual who signs the application in **Item 13** of the DPH Form 45013, '*Application for a Radioactive Material License Authorizing the use of Industrial Radiography*' (**Appendix A**).

To be considered eligible for the RSO position, an individual must be a qualified radiographer, have a minimum of 2,000 hours (one-year full-time field experience) of hands-on experience as a qualified radiographer, and have formal training in establishing and maintaining a radiation protection program. This should be a course specifically designed to provide training in running a radiation safety program, a basic radiation safety course is not acceptable. While a course particular to industrial radiography would be highly encouraged, this is not required. Hands-on experience means experience in all areas considered to be directly involved in the radiography process, this includes taking radiographs, surveying devices, transporting the radiography equipment to temporary jobsites, posting, work sites, radiation area surveillance, and completing and maintaining records. Excessive time spent in only one or two of these operations (film development and/or area surveillance) should not be counted toward the 2,000 hours. Experience with radiography using x-rays can be included; however, the majority of experience should be in isotope radiography.

DHFS will consider individuals with alternative training and experience as RSOs. For example, a person certified in health physics or industrial hygiene with previous experience in managing a radiation safety program of comparable size and scope could be considered on an individual case. The qualifications, training, and experience required of the RSO may vary depending upon the complexity of the applicant's operations and number of radiography personnel.



**Figure 2: RSO Responsibilities.** Typical duties and responsibilities of RSOs.



## Response from Applicant:

### Item 5 Radiation Safety Officer (RSO) (Check all that apply)

- ☐ The name of the proposed RSO and other potential designees who will be responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures.

NAME: \_\_\_\_\_ TELEPHONE NUMBER: \_\_\_\_\_  
(Include area code)

AND

- ☐ We will demonstrate that the RSO has sufficient independence and direct communication with responsible management officials by providing a copy of an organizational chart by position and will confirm that the RSO has day-to-day oversight of the radiation safety activities.

AND EITHER

- ☐ We will provide the specific training and experience of the RSO.  
Including the:
1. Specific dates of certification and/or training in radiation safety.
  2. Documentation to show that the RSO has a minimum of 2,000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations.
  3. Documentation to show that the RSO has obtained formal training in the establishment and maintenance of a radiation protection program.

OR

- ☐ We will provide alternative information demonstrating that the proposed RSO is qualified by training and experience (e.g. Board Certification by the American Board of Health Physicists, completion of a bachelor's and/or master's degree in the sciences with at least one year of experience in the conduct of a radiation safety program of comparable size and scope) documentation to show that the RSO has obtained formal training in the establishment and maintenance of a radiation protection program.

**Note:** It is important to notify DHFS and obtain a license amendment prior to making changes in the designation of the RSO responsible for the radiation safety program. If the RSO leaves the organization before an amendment is approved by DHFS, a potential designee, who meets the RSO qualification requirements, is responsible for ensuring that the licensee's radiation safety program is implemented in accordance with the license and DHFS rule.

### Item 6: Training for Radiographers and Radiographer's Assistants

**Rule:** *HFS 157.13(2) & (6); HFS 157.44(3); HFS 157.88(2)*

**Criteria:** Radiographers and radiographer's assistants must have adequate training and experience as outlined in *HFS 157.44(3)*.

#### Discussion:

- A radiographer is a person who performs or personally supervises industrial radiography and is responsible for ensuring compliance with DHFS rules and the safe use of radioactive materials.
- A certified radiographer is an individual who has been certified by a certifying entity such that

he/she has met established radiation safety, testing, and experience criteria.

- A radiographer's assistant is an individual, who under the direct supervision (in the physical presence) of the radiographer uses radiographic equipment in performing industrial radiographic operations.

*HFS 157.44(3)* describes specific training requirements for radiographers and radiographer's assistants and requires that all radiographers be certified. It also addresses annual refresher training and semiannual audits of radiographers and radiographer's assistants.

Refer to **Appendix G** as an aid to determining the specific training requirements for radiographers and radiographer's assistants. The applicant must submit a description of their training program for radiographers and radiographer's assistants.

Because *HFS 157.44(3)* contains different requirements for radiographers and radiographer's assistants, include training programs for each. When describing the training programs for these positions, include the sequence of events from the time of hiring through the designation of individuals as radiographers or radiographer's assistants. Experienced radiographers who have worked for another licensee should receive formal instruction similar to that given to prospective radiographer's assistants. This instruction must include training in your operating and emergency procedures, in the use of your exposure devices and associated equipment, and in the use of survey meters and other radiation monitoring devices.

Instructors who provide classroom training to individuals in the principles of radiation and radiation safety should have knowledge and understanding of these principles beyond those obtainable in a course similar to the one given to prospective radiographers. Individuals who provide instruction in the hands-on use of radiography equipment should be qualified radiographers with at least 1 year of experience in performing radiography, or should possess a thorough understanding of the operation of radiographic equipment (e.g., a manufacturer's service representative).

An internal inspection program (audit program) of the job performance of each radiographer and radiographer's assistant ensures that DHFS's rules, license requirements, and the licensee's operating and emergency procedures are followed. The audit must include observation of the performance of each radiographer and radiographer's assistant during an actual industrial radiographic operation at intervals not to exceed 6 months. If a radiographer or radiographer's assistant has not participated in an industrial radiographic operation for more than 6 months, the individual must demonstrate knowledge of the training requirements by practical examination before participating in a radiographic operation. The person conducting internal inspections should

have a minimum of one-year actual experience as a radiographer.

The applicant shall:

- Submit an outline of the training to be given to prospective radiographer's assistants. Submit your procedures for experienced radiographers who have worked for another licensee.
- Specify the qualifications of your instructors in radiation safety principles and describe their experience with radiography. If training will be conducted by someone outside the applicant's organization, identify the course by title and provide the name and address of the company providing the training.
- Describe the field (practical) examination that will be given to radiographer's assistants. DHFS suggests using the checklist in **Appendix H** as a source of potential areas to review during the field examination.
- Describe the annual refresher training program, including topics to be covered and how the training will be conducted.
- Submit your procedures for verifying and documenting the certification status for verifying that their certification remains valid. As a minimum your procedures for newly hired, previously certified individuals should require documentation of your contacting the certifying entity and confirming the certification. Your procedures should also ensure you are aware of certification expiration dates and that individuals with expired certifications do not act as radiographers.
- Submit a description of your program for inspecting the job performance of each radiographer and radiographers' assistant at intervals not to exceed 6 months as described in **HFS 157.44(3)**.

## Response from Applicant:

### Item 6 Training For Radiographers and Radiographer's Assistants (Check both boxes)

☐ Before using radioactive material radiographers will be certified through a radiographer certification program administered by a certifying entity.

AND

☐ We will submit the information outlined in section titled 'Training for Radiographers and Radiographer's Assistants' in WISREG 'Guidance for Industrial Radiography Use'

**Note:** X-ray training by itself will not be considered adequate experience for performing gamma radiography.

## ITEM 7: Radioactive Material

**Rule:** *HFS 157.13(1) & (2); HFS 157.36*

**Criteria:** Applicants must provide the manufacturer's (or distributor's) name and model number for each requested source assembly (sealed source), exposure device, and source changer. Licensees will only be authorized for radiographic exposure devices, source assemblies or sealed sources containing radioactive material and associated equipment meeting DHFS performance requirements and specifically approved or registered by the NRC or an Agreement State. Also, identify any depleted uranium that is used as shielding material (radiographic exposure devices, source changers and some collimators contain depleted uranium).

**Discussion:** The NRC or an Agreement State performs a safety evaluation of radiography source assemblies (sealed sources) exposure devices and source changers prior to distribution of these sources/devices to specific licensees. The safety evaluation is documented in a Sealed Source and Device (SSD) Registration Certificate issued to the manufacturer (or distributor). Therefore, if the source assemblies, exposure devices, or source changers are approved for use by the NRC or an Agreement State, the applicant need only note the manufacturer's (or distributor's) name and model number of the sources/devices in its license application to demonstrate that the requirements are met. Consult with the proposed supplier to ensure that sources and devices conform to the sealed source and device designations registered with the NRC or an Agreement State. For licensees to ensure that they use radiographic equipment in accordance with registration certificates, licensees may want to review the certificate, discuss with the manufacturer, or obtain a copy of the certificate. Licensees may not make modifications to exposure devices, source changers, source assemblies and associated equipment unless the design of any replacement component, including source holder, source assembly, controls or guide tubes would not compromise the safety features of the system.

Consult with the manufacturer of the associated equipment (i.e., equipment that is used in conjunction with the exposure device that drives, guides, or comes in contact with the source) to be sure that the associated equipment is compatible with the sources and devices. Licensees must demonstrate that associated equipment meets the performance requirements in **HFS 157.36** equivalent to **10 CFR 34.20**. NRC information Notice 96-20: *Demonstration of Associated Equipment Compliance with 10 CFR 34.20* (**Appendix F**) contains a number of ways that licensees can demonstrate that their associated equipment meets performance requirements.

**Response from Applicant:**

Item 7 Sealed Source Radioactive Material (Attach additional pages if necessary)	
Element and mass number	Sealed source manufacturer and model number
Maximum activity per source	Exposure device manufacturer and model number
Source changer manufacturer and model Number	Sealed source and device registration sheet number
Is Depleted Uranium used as a shielding material? <input type="checkbox"/> Yes <input type="checkbox"/> No  Only radiographic exposure devices, source assemblies or sealed sources, and associated equipment which meets the requirements specified in s. HFS 157.36 will be used in radiographic operations. <input type="checkbox"/> Yes <input type="checkbox"/> No	

**Note:** The following tables list several devices with associated radionuclides and amounts:

**Table 2: Industrial Nuclear Model Ir-100 Exposure Device Maximum Authorization -- 120 Ci**

<b>Element</b>	<b>Sealed Source</b>	<b>Curies</b>	<b>Source Changer Meeting 10 CFR 34 Requirements</b>	<b>Maximum Curies Authorized</b>
Ir-192	IN Model 32	120 Ci	Amersham 550-SU IN IR-50	120 Ci 120 Ci
Ir-192	IN Model 33	120 Ci	Amersham 550 -SU IN IR-50	120 Ci 120 Ci
Ir-192	Amersham 87703	120 Ci	Amersham 550 -SU Amersham 650L Amersham 820 Amersham 855 IN IR-50	120 Ci 240 Ci 1,000 Ci 960 Ci 120 Ci
Ir-192	Amersham 87704	120 Ci	Amersham 550 -SU Amersham 650 Amersham 820 Amersham 855	120 Ci 240 Ci 1,000 Ci 960 Ci
Ir-192	SPEC G-40F	120 Ci	Amersham 550 -SU SPEC C-1 IN IR-50	120 Ci 150 Ci 120 Ci
Ir-192	SPEC G-40T	120 Ci	Amersham 550 -SU SPEC C-1 IN IR-50	120 Ci 150 Ci 120 Ci

**Table 3: Spec Model 150 Exposure Device Maximum Authorization -- 150 Ci**

<b>Element</b>	<b>Sealed Source</b>	<b>Curies</b>	<b>Source Changer</b>	<b>Curie Authorization</b>
Ir-192	SPEC G-60	240 Ci	SPEC C-1	150 Ci

**Table 4: Amersham Model 680 System Exposure Device Maximum Authorization -- 110 Ci**

<b>Element</b>	<b>Sealed Source</b>	<b>Curies</b>	<b>Source Changer</b>	<b>Curie Authorization</b>
Co-60	Amersham A424- 14	110 Ci	Amersham 770 Amersham 771	550 Ci 110 Ci
Co-60	Amersham 943	110 Ci	Amersham 770 Amersham 771	550 Ci 110 Ci

**Table 5: Amersham Model 660 System Exposure Device Maximum Authorization -- 140 Ci**

Element	Sealed Source	Curies	Source Changer	Curie Authorization
Ir-192	IN Model 7	100 Ci	Amersham 550 -SU Amersham 650L Amersham 820 Amersham 855 IN IR-50 SPEC C-1	120 Ci 240 Ci 1,000 Ci 960 Ci 120 Ci 150 Ci
Ir-192	CIS-US 702	120 Ci	Amersham 550 -SU IN IR-50 SPEC C-1	120 Ci 120 Ci 150 Ci
Ir-192	Amersham 91813	20 Ci	Amersham 650L	240 Ci
Ir-192	Amersham A424-22	240 Ci	Amersham 550 -SU Amersham 650L Amersham 820 Amersham 855	120 Ci 240 Ci 1,000 Ci 960 Ci
Ir-192	Amersham A424-9	240 Ci	Amersham 550 -SU Amersham 650L Amersham 820 Amersham 855 IN IR-50 SPEC C-1	120 Ci 240 Ci 1,000 Ci 960 Ci 120 Ci 150 Ci

## Item 8: Financial Assurance and Recordkeeping for Decommissioning

**Rule:** *HFS 157.13(9) & (10), HFS 157.15*

**Criteria:** Industrial radiography licensees authorized to possess sealed sources containing radioactive material in excess of the limits specified in *HFS 157.15* must provide evidence of financial assurance for decommissioning.

Licensees are required to maintain, in an identified location, decommissioning records related to structures and equipment where devices are used or stored and records related to leaking sources. Licensees must transfer these records important to decommissioning either to any new licensee before licensed activities are transferred or assigned in accordance with *HFS 157.13(10)*, or to DHFS before license is terminated.

**Discussion:** The requirements for financial assurance are specific to the types and quantities of byproduct material authorized on a license. Most industrial radiography applicants and licensees do not need to comply with the financial assurance requirements because the thresholds for sealed sources containing radioactive

material are  $3.7 \times 10^5$  Bq (10,000 curies) of cobalt-60 and  $3.7 \times 10^6$  Bq (100,000 curies) of cesium-137 or byproduct material with half-lives less than 120 days (e.g., iridium-192). Thus, a licensee would need to possess hundreds of sources before the financial assurance requirements would apply. Since the standard industrial radiography license does not specify the maximum number of sources that the licensee may possess (allowing the licensee flexibility in obtaining sources/devices as needed without amending its license), it contains a condition requiring the licensee to limit its possession of sources to quantities not requiring financial assurance for decommissioning. Applicants and licensees desiring to possess sources exceeding the threshold amounts must submit evidence of financial assurance.

The same rule also requires that licensees maintain records important to decommissioning in an identified location. All industrial radiography licensees need to maintain records of structures and equipment where radioactive material was used or stored. As-built drawings with modifications of structures and equipment shown as appropriate fulfill this requirement. If drawings are not available, licensees shall substitute appropriate records (e.g., a sketch of the room or building or a narrative description of the area) concerning the specific areas and locations. If no records exist regarding structures and equipment where radioactive materials were used or stored, licensees shall make all reasonable efforts to create such records based upon historical information (e.g. employee recollections). In addition, if radiography licensees have experienced unusual occurrences (e.g., incidents that involve spread of contamination, leaking sources), they also need to maintain records about contamination that remains after cleanup or that may have spread to inaccessible areas.

### Response from Applicant:

#### Item 8 Financial Assurance And Recordkeeping For Decommissioning (Check both boxes)

☐ We shall maintain drawings and records important to decommissioning and will transfer these records to a new licensee before licensed activities are transferred in accordance with s. HFS 157.15(7)(a) and (c) or assign the records to DHFS before the license is terminated.

AND

☐ If financial assurance is required, submit evidence per s. HFS 157.15 'Financial Assurance and records for decommissioning'.

**Note:** If financial assurance is required, submit the documentation required under **HFS 157.15**. NRC Regulatory Guide 3.66, '*Standard Format and Content of Financial Assurance Mechanisms Required for Decommissioning Under 10 CFR Parts 30, 40, 70, and 72*' dated June 1990, contains approved wording for each of the mechanisms authorized by the regulation to guarantee or secure funds except for the Statement of Intent for Government licensees. This document is available from the NRC website at: [www.nrc.gov](http://www.nrc.gov) or DHFS upon request.



## Item 9: Facilities and Equipment

**Rule:** *HFS 157.03; HFS 157.13(2) & (6); HFS 157.23(1); HFS 157.26(1); HFS 157.28(1); HFS 157.42; HFS 157.45(14)*

**Criteria:** Licensees must specifically identify and describe permanent radiographic installations, field stations, and any other locations where radiography will be conducted.

**Discussion:** A permanent radiographic installation is an enclosed shielded room, cell, or vault, not located at a temporary jobsite, in which radiography is performed. A facility is considered “permanent” if it is intended to be used for radiography, even if radiography is rarely performed there. The nature of the installation, rather than the frequency of use, determines a permanent radiographic installation. All radiographic operations conducted at locations of use authorized on the license must be conducted in a permanent radiographic installation unless specifically authorized by DHFS. If licensees need to perform radiography at their place of business outside of a permanent radiographic installation due to unique circumstances (the item to be radiographed is too large for the facility), then DHFS must authorize this method of use. In this case, two individuals must be present whenever radiographic operations occur outside of a permanent radiographic installation.

The one primary (and perhaps the most important) reason licensees have for conducting radiography in a permanent radiographic installation is that they can limit access. In order to ensure this control, a permanent radiographic installation located on the ground, must be enclosed by a minimum of four shielded walls (otherwise the floor must also be shielded). The use of materials that do not realistically provide shielding, do not qualify. Areas outside of the facility generally should qualify as unrestricted areas. While the area outside of a permanent radiographic installation should qualify as an unrestricted area (i.e., not exceed 2mR/hr), the rule does not specify radiation limits in order to allow for design flexibility for moving equipment into and out of the permanent radiographic installation, or other considerations. Radiation levels slightly exceeding these levels outside of the installation should only be considered or allowed when the higher levels are due to "sky shine" or the need for equipment movement. If the roof of the installation does not qualify as a restricted area, or if no roof exists, mechanical access restrictions (fence, etc.) must be utilized and additional administrative controls must be imposed to ensure that unwanted access can be gained only through extraordinary effort. All entrances into the installation must be interlocked with required control devices as per *HFS 157.26(1)*. Unless all entrances are locked, at least one radiographer must be present at the facility whenever radiography is being performed.

A field station is a facility where licensed material may be stored or used and from which equipment is dispatched. Radiographic operations may be conducted in a permanent radiographic installation or at the place of business in the same manner as described above.

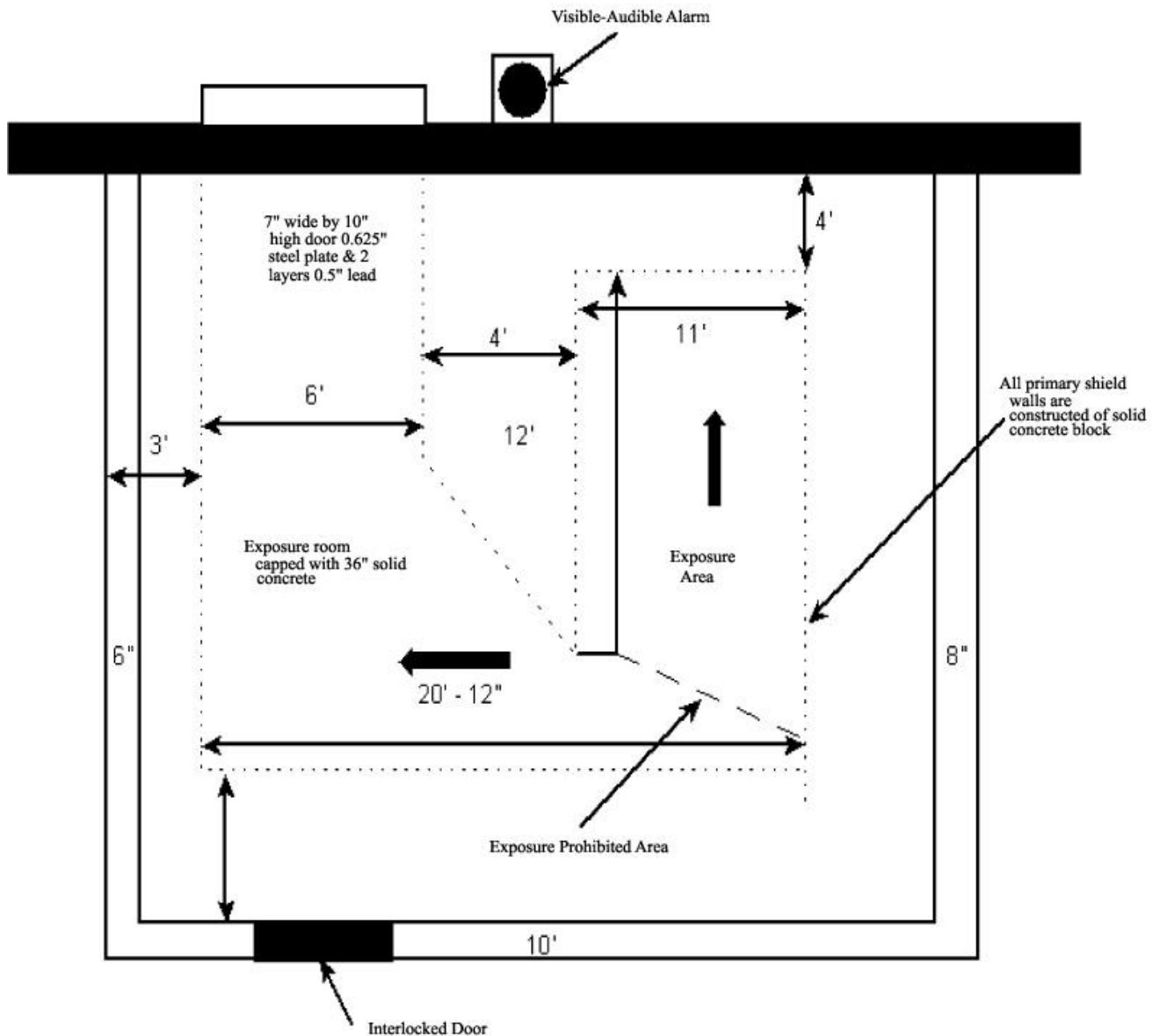
A restricted area is an area that licensees limit access for the purpose of protecting individuals from undue risks from exposure to sources of radiation. A restricted area cannot include areas used as residential quarters, consequently industrial radiography devices must not be stored in motel rooms or similar locations.

Requirements for a permanent radiographic installation:

- Each access point is equipped with a visible-audible signal system. The visible signal is activated by radiation whenever the source is exposed. The audible signal will sound if anyone tries to enter the installation while the source is exposed. The requirement for the visible-audible signal system is in addition to other measures that may be taken to prevent access to the installation, such as locked doors.

As an alternative to the visible-audible alarm system, it is acceptable to use a control system that will reduce the radiation level if the entrance to a high-radiation area is opened while the source is out. The system must be automatic and independent of radiography personnel action. If this alternative is planned, provide a description of the system.

- Diagram depicting the shielding, layout, and audible-visual alarms. A diagram of the installation is helpful in evaluating the shielding and determining compliance with rules regarding restricted and unrestricted areas, location of access points, and locations of audible-visible signals. **Figure 3** shows an example installation diagram; and



**Figure 3: Diagram of a Permanent Radiographic Installation.**

- Calculations or survey results of radiation levels:

For a determination of installation adequacy, provide information showing that the radiation level in all directions around the installation, including the roof, will not exceed a dose of 0.02 mSv (2 mrem) in any one hour. Take into account the highest quantity of radioactive material that will be used in the installation and any limitations on source positioning in the installation. Radiation levels in all directions around the installation that are below 0.02 mSv (2 mrem) in any one hour are considered acceptable. If the radiation levels will exceed 0.02 mSv (2 mrem) in any one hour, then steps should be taken (use lower-activity source, use collimator, or move setup farther away) to reduce the radiation to the acceptable level.

A radiation level on the roof that exceeds 1.0 mSv (100 mrem) in one hour at 30 cm from the surface is considered a "high radiation area" and requires special precautions to control access to the area. Licensees should make efforts to lower a radiation level exceeding 1.0 mSv (100 mrem) in any one hour by using additional shielding, collimators, or other engineering controls. The roof of a fixed radiography cell is a potentially occupied area, and applicants must demonstrate that no individual member of the public could receive effective doses in excess of 0.02 mSv (2 mrem) in any one hour or 1 mSv (100 mrem) in a year.

Provide the following as applicable:

- If radiography is planned in a permanent radiography installation or installations (including field stations with permanent exposure cells), provide the following information for each installation:
  - An annotated sketch or drawing of the facility and its surroundings. The scale to which the sketch or drawing is made. The same scale should be used for all sketches and drawings; The recommended scale is 1/4 inch = 1 foot. Drawings to this scale that do not fit on 8 ½" X 11" paper may be provided as sectional drawings;
  - The type, thickness and density of shielding materials on all sides, including the floor and the roof;
  - The locations of entranceways and other points of access to the facility;
  - A description of the areas adjacent to the facility and the distance to these areas. Include information on areas adjacent to, above, and below the facility;
  - A description of the general location of each proposed permanent installation listed in **Item 4** (e.g., located in an industrial park, an office complex, etc.) and its current use. If any proposed permanent installation is a private residence, provide diagrams of the installation that include the building, the proposed restricted area(s), and adjacent areas, including above and below the restricted areas; provide commitments that restricted areas do not include residential quarters, and explain how radiation levels in unrestricted areas will be maintained at less than 1 mSv (100 mrem) per year;
  - A description of the visible-audible signal system or entrance control system and its location.
  - The results of radiation-level calculations or actual radiation measurements adjacent to, above, and below the installation. The radiation level in all directions around the installation, including the roof, should not exceed 0.02 mSv (2 mrem) in any one hour. Clearly identify the type of source (isotope), the amount of radioactive material in the source, and the position of the source

within the installation for the calculations or measurements.

- Variances will be considered if construction requirements preclude shielding the roof in order to meet the requirement not to exceed 0.02 mSv (2 mrem) in any one hour. Provide the following information to obtain approval for a variance:
  - Procedures for ensuring that no individual is on the roof or could gain access to the roof during radiography;
  - Means of preventing access to the roof;
  - A commitment that the roof will be posted with "Caution (or Danger) Radiation Area" signs;
  - Steps taken to minimize radiation on the roof; and
  - Limitations (if needed) on positioning of sources or type (isotope) and amount of radioactive material that may be used in the installation to ensure that areas adjacent to, above, and below the installation will be unrestricted areas during the performance of radiography.
- If radiation levels on the radiography installation roof exceed 1.0 mSv (100 mrem) in any one hour, then provide the following information in addition to the items above to apply for this variance:
  - A commitment that the roof will be posted with "Caution (or Danger) High Radiation Area" signs;
  - Evidence of constant surveillance of the roof by closed circuit TV;
  - Fluctuation of the dose rate;
  - A description of a control device that would automatically reduce the radiation level to 1 mSv (100 mrem) in any one hour at 30 cm from the radiation source if someone accesses the roof; and
  - A description of a control device that activates a visible-audible signal so that both an individual accessing the roof and the radiographer on duty are made aware of the entry.
- Field Stations:
  - Describe the storage location(s) at the address(es) listed in **Item 4** and submit a diagram showing where the radiography camera will be stored at the field stations. Indicate whether or not radiography will be performed at the place of business outside of a permanent radiography installation. If radiography will be performed at a site outside of a permanent radiography installation, provide a diagram of the location where radiography may be performed and its surroundings, including a description of adjacent property;

## Response from Applicant :

### Item 9 Facilities And Equipment (Check box and attach requested information)

- ☐ We will submit the required information as listed in the section titled 'Facilities and Equipment' of WISREG 'Guidance for Industrial Radiography Use'.

**Note:** Certain records described in the rule pertaining to radiation safety may need be on file at these field stations and each temporary jobsite.

Rem, and its SI equivalent Sievert, will be used in this guide whenever units of radiation exposure or dose are required. This is done since **Chapter HFS 157 'Radiation Protection'** sets dose limits in units of rem, not rad or roentgen, and the sealed sources used in radiography emit gamma rays. A useful rule of thumb for gamma radiation is an exposure of 1 roentgen is equivalent to an absorbed dose of 1 rad and dose equivalent of 1 rem.

## ITEM 10: Radiation Safety Program

**Rule:** *HFS 157.13(2) & (6); HFS 157.21*

**Criteria:** A radiation protection program must be established and submitted to DHFS as part of the application. The program must be commensurate with the scope and extent of activities for the use of licensed materials in industrial radiography. Each applicant for an industrial radiography license must develop, document, and implement a radiation protection program containing the following elements:

- Steps to keep radiation exposures as low as reasonably achievable (ALARA);
- Description of equipment and facilities adequate to protect personnel, the public and the environment;
- Conduct of licensed activities by individuals qualified by training and experience;
- Written operating and emergency procedures;
- Program to inspect the job performance of radiographic personnel ;
- Description of organization structure and individuals responsible for ensuring implementation of radiation safety program; and
- Records management.

**Discussion:** The specific components of the applicant's radiation safety program are detailed in this WISREG. Some topics will not require the applicant to submit information as part of an application, but simply provide the applicant with guidance to comply with a specific DHFS requirement.

## **Item 10.1: Radiation Safety Program Audit**

**Rule:** *HFS 157.21; HFS 157.31(2)*

**Criteria:** Licensees must review the content and implementation of their radiation protection programs annually to ensure:

- Compliance with DHFS and DOT requirements, and the terms and conditions of the license;
- Occupational doses and doses to members of the public that are ALARA; and
- Records of audits and other reviews of program content are maintained for 3 years.

**Discussion:** **Appendix I** contains a suggested annual audit program that is specific to industrial radiography and is acceptable to DHFS. All areas indicated in **Appendix I** may not be applicable to every licensee and may not need to be addressed during each audit.

Audit records acceptable to DHFS should contain the following information:

- Date of audit;
- Name of person(s) who conducted the audit;
- Names of persons contacted by the auditor(s);
- Areas audited;
- Audit findings, and corrective actions; and
- Follow-up.

It is essential that once identified, problems be corrected in a timely manner. NRC Information Notice (IN) 96-28, '*Suggested Guidance Relating to Development and Implementation of Corrective Action*' provides guidance on this subject. DHFS will review the licensee's audit results and determine if corrective actions are thorough, timely, and sufficient to prevent recurrence. If violations are identified by the licensee and these steps are taken, DHFS can exercise discretion and may elect not to cite a violation. DHFS's goal is to encourage prompt identification and prompt comprehensive correction of violations and deficiencies.

## Response from Applicant :

### Item 10.1 Radiation Safety Program Audit

The applicant is not required to submit its audit program to DHFS for review during the licensing phase. This matter will be examined during an inspection.

## Item 10.2: Termination of Activities

**Rule:** *HFS 157.13; HFS 157.15; HFS 157.31; HFS 157.32(8)*

**Criteria:** The licensee must do the following:

- Notify DHFS, in writing, within 30 days of:
  - Decision to permanently discontinue all activities involving materials authorized under the license.
- Notify DHFS, in writing, within 60 days of:
  - The expiration of its license;
  - A decision to permanently cease licensed activity at the entire site or in any separate building or outdoor area if it contains residual radioactivity making it unsuitable for release according to DHFS requirements;
  - No principal activities have been conducted at the entire site under the license for a period of 24 months;
  - No principal activities have been conducted for a period of 24 months in any separate building or outdoor area if it contains residual radioactivity making it unsuitable for release according to DHFS requirements.
- Submit a decommissioning plan, if required by *HFS 157.13(11)(f)*;
- Conduct decommissioning, as required by *HFS 157.13(11)(j)* and *HFS 157.13(11)(l)*;
- Submit to DHFS, a completed DPH Form 4507 ‘Certificate of Disposition of Materials’ (**Appendix B**) and demonstrate that the premises are suitable for release for unrestricted use (e.g. results of final survey); and
- Before a license is terminated, send the records important to decommissioning to DHFS. If licensed activities are transferred or assigned in accordance with *HFS 157.13(5)(c) 2*, transfer records important to decommissioning to the new licensee.



**Discussion:** For guidance on the disposition of radioactive material, see **Item 11** 'Waste Management'. For guidance on decommissioning records, see **Item 8** 'Financial Assurance and Record Keeping for Decommissioning'.

**Response from Applicant:**

**Item 10.2 Termination Of Activities** (Check box )

- ☐ We will notify the department, in writing, within 30 days of the decision to permanently cease radioactive material use.  
s. HFS 157.13(10)(d)

**Item 10.3: Instruments**

**Rule:** *HFS 157.13(2); HFS 157.38; HFS 157.41; HFS 157.45(3)*

**Criteria:** A radiation survey meter intended for industrial radiography that utilizes sealed radioisotope sources should be capable of accurately measuring the radiation fields produced by the sealed radiography source currently in use, and be visually checked for damage and for proper operation with a check source or other appropriate means, such as an exposure device, before use on each day it is to be used. The survey meter shall be calibrated at intervals not to exceed 6 months and after each servicing, (except for battery changes). Written procedures are required for inspection and routine maintenance of the survey meters, which is to be performed at intervals not to exceed 3 months or before the first use thereafter to ensure proper functioning of components important safety.

**Discussion:** Licensee shall keep an adequate number of appropriate radiation survey instruments that are both calibrated and operable, at each location where radioactive material is present to make the required radiation surveys. The instrument shall be capable of measuring a range from 0.02 mSv (2 mrem) per hour through 10 mSv (1 rem) per hour. Each radiation survey instrument shall be calibrated at intervals not to exceed 6 months and after instrument servicing, except for battery changes. Records of survey instrument calibrations will be retained for a minimum of 3 years. Records are to be made of equipment problems and maintenance performed and these shall be retained for 3 years.

## Response from Applicant :

### Item 10.3 Instruments (Check all boxes that apply)

- ☐ We will possess and use radiation survey meter(s) that meets the Criteria in the section titled "Instruments" in WISREG "Guidance for Industrial Radiography Use".

AND EITHER

- ☐ If calibration is performed by a person or firm outside the applicant's organization, the calibration will be performed by a DHFS, NRC or Agreement State licensee specifically authorized to perform instrument calibration.

OR

- ☐ We will follow the survey meter calibration procedures in accordance with Appendix J in WISREG "Guidance for Industrial Radiography Use".

OR

- ☐ We will submit alternate procedures. (Procedures are attached)

Note: Identify the qualifications of the individuals who will perform the calibrations if performed by the applicant.

**Note:** For detailed information about survey instrument calibration, refer to ANSI N323-1978, '*Radiation Protection Instrumentation Test and Calibration*'. Reaffirmed 1993 copies may be obtained from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

## Item 10.4: Material Receipt and Accountability

**Rule:** *HFS 157.06(1); HFS 157.13(15) & (18); HFS 157.40; HFS 157.45(2)*

**Criteria:** Licensees must do the following:

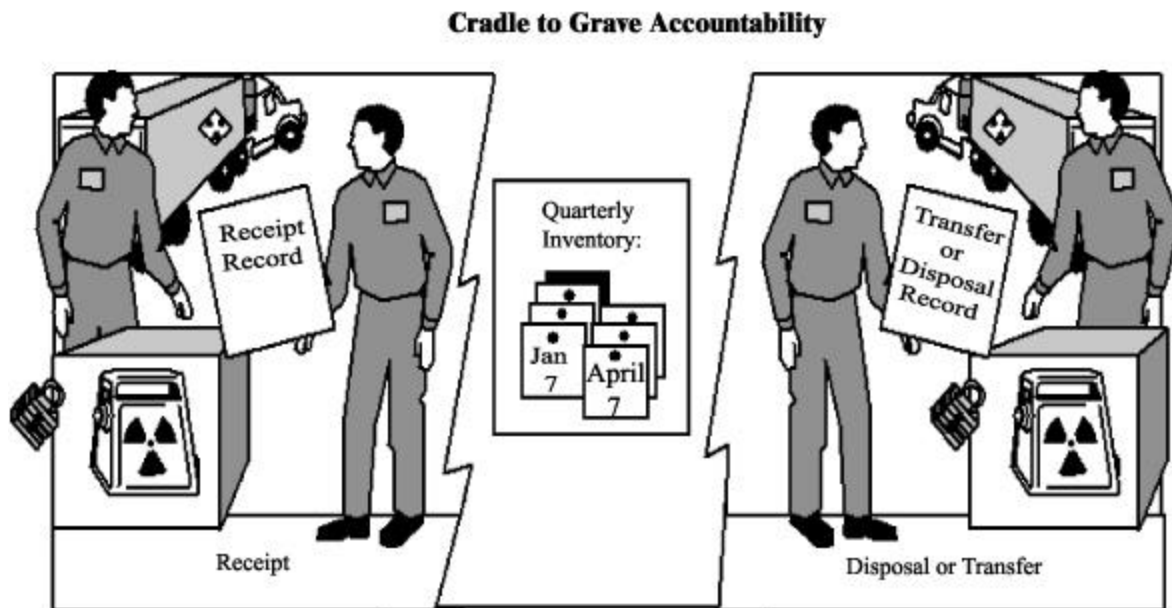
- Maintain records of receipt, transfer, and disposal of sources/devices;
- Conduct physical inventories at quarterly intervals (not to exceed 3 months) to account for all sources of radiation and for devices, including devices containing depleted uranium;

**Discussion:** As illustrated in **Figure 4** below, licensed materials must be tracked from "cradle to grave" in order to ensure accountability; identify when sources/devices may be lost, stolen, or misplaced; and ensure that the possession limit stated on the license is not exceeded.

Conduct physical inventories (i.e., locate, verify the presence of the material, and account for it in material transfer record) at quarterly intervals (not to exceed 3 months) to account for all sealed sources and devices containing depleted uranium.

Maintain inventory records that contain the following types of information:

- Radionuclide and amount (in units of Bq or curies) of radioactive material in each sealed source;
- Manufacturer's name, model number, and serial number of each sealed source containing radioactive material;
- Manufacturer's name, model number, and serial number of each device containing depleted uranium or radioactive material;
- Location of each sealed source and device;
- Date of the inventory; and
- Name of individual performing inventory.



**Figure 4: Material Receipt and Accountability**

**Response from Applicant :**

**Item 10.4 Material Receipt And Accountability (Check box)**

- ☐ Quarterly physical inventories (not to exceed 3 months) will be conducted of all sealed sources and/or devices containing radioactive material (including depleted uranium) and the information contained in the discussion section titled 'Material Receipt and Accountability' in WISREG 'Guidance for Industrial Radiography Use' will be documented.

## Item 10.5: Leak Tests

**Rule:** *HFS 157.13(6); HFS 157.39; HFS 157.45(4)*

**Criteria:** DHFS requires testing to determine whether there is any radioactive leakage from the source or from devices containing depleted uranium shielding. DHFS finds testing to be acceptable if it is conducted by an organization licensed by DHFS, the NRC, or an Agreement State, or conducted in accordance with procedures approved by DHFS.

**Discussion:** Manufacturers, consultants, and other organizations may be authorized by DHFS, the NRC or an Agreement State to either perform the entire leak test sequence for other licensees or provide leak test kits to licensees. In the latter case, the licensee is expected to take the leak test sample according to the device manufacturer's and the kit supplier's instructions and return it to the kit supplier for evaluation and reporting results. Licensees may also be authorized by DHFS to conduct the entire leak test sequence themselves. Measurement of the leak-test sample is a quantitative analysis requiring that instrumentation used to analyze the sample be capable of detecting 185 Bq (0.005 microcurie) of radioactivity.

Sealed sources containing radioactive material must be leak tested at intervals not to exceed 6 months and DU devices tested at intervals not to exceed 12 months.

### Response from Applicant :

#### Item 10.5 Leak Test (Check one box)

- ☐ Leak tests will be performed by an organization authorized by DHFS, the NRC or an Agreement State to provide leak testing services to other licensees; or by using a leak test kit supplied by an organization licensed by DHFS, the NRC or an Agreement State to provide leak test kits to other licensees according to kit suppliers' instructions.

List the name and license number of organization authorized to perform or analyze leak test ( Specify whether DHFS, NRC, or other Agreement State):

Organization Name \_\_\_\_\_ License Number \_\_\_\_\_

**Note:** An alternate organization may be used to perform or analyze leak test, without amending the license, provided the organization is specifically authorized by DHFS, the NRC or an Agreement State.

OR

- ☐ We will perform our own leak testing and sample analysis. We will follow the procedures in Appendix K of WISREG 'Guidance for Industrial Radiography Use'.

OR

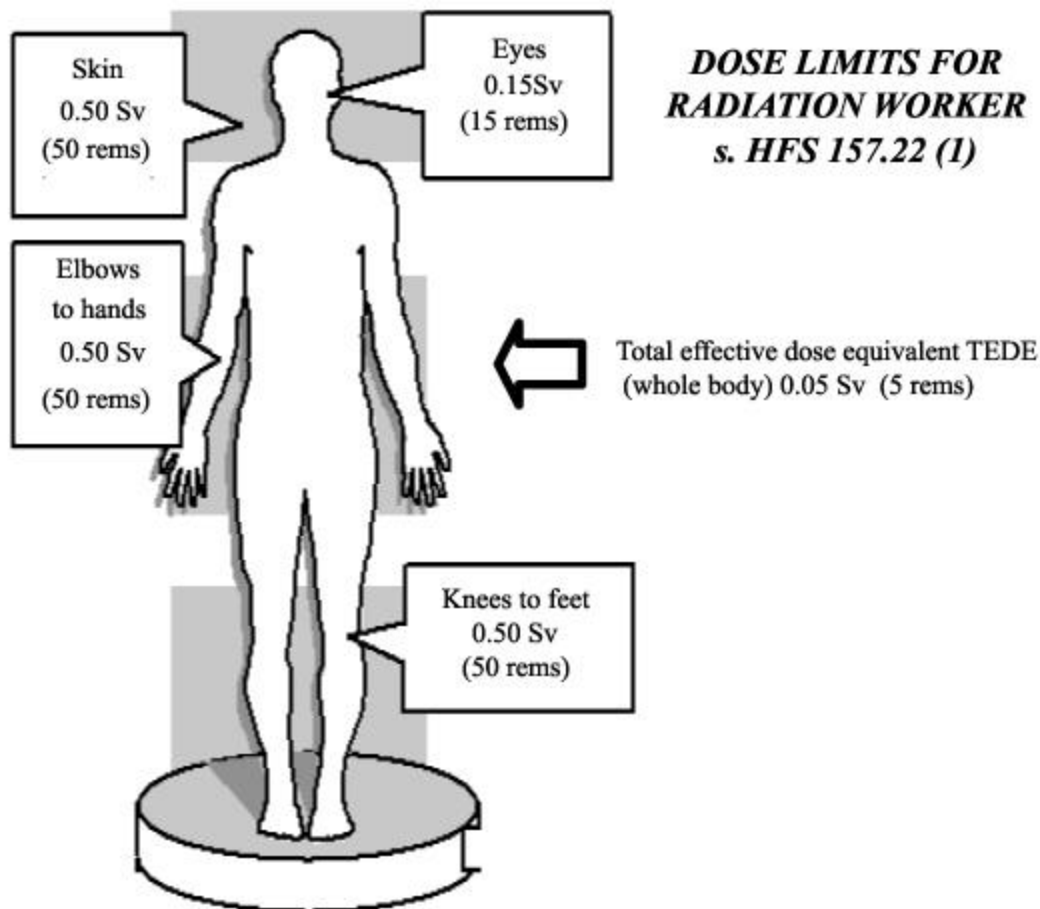
- ☐ We will submit alternative procedures. (Procedures are attached)

**Note:** Requests for authorization to perform leak testing and sample analysis will be reviewed on a case-by-case basis and, if approved, DHFS staff will authorize via a license condition.

## Item 10.6: Occupational Dosimetry

**Rule:** *HF S 157.22(1), (7) & (8); HFS 157.88(3)*

**Criteria:** Licensees must provide to employees dosimetry processing that has been accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) operated by the National Institute of Standards and Technology (NIST).



**Figure 5: Dose Limits.** Dose limits for radiation workers.

**Discussion:** The licensee may not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations each individual wears, on the trunk of the body, a combination of a direct-reading dosimeter (pocket dosimeter or electronic personal dosimeter), an operating alarm ratemeter, and either a film badge, TLD or similar approved device. At permanent radiography installations where other appropriate alarming or warning devices are in routine use, wearing an alarming

ratemeter is not required. The pocket dosimeters must have a range from zero to 2 mSv (200 mrem), must be recharged at the start of each shift, and must be checked for correct response to radiation at intervals not to exceed 12 months. Electronic personal dosimeters may only be used in place of ion-chamber pocket dosimeters. Alarm ratemeters must be preset to give an alarm signal at a dose rate of 5 Sv/hr (500 mrem/hr) and must be calibrated for correct response at intervals not to exceed 12 months.

Film badges, TLDs or similar approved devices must be replaced at frequencies recommended by the processor (i.e. not to exceed 1 month for film badges and 3 months for TLDs).

### Response from Applicant:

**Item 10.6 Occupational Dosimetry** (Check all boxes that apply)

- ☐ We will provide dosimetry processed and evaluated by a NVLAP-approved processor that is exchanged at a frequency recommended by the processor.
- AND
- ☐ The required personnel monitoring equipment, including 0 to 2 mSv (200 mrem) dosimeters or electronic personal dosimeters, will be worn by radiographic personnel.
- AND
- ☐ Alarming ratemeters set to alarm at plus or minus 20% of 500mrem/hour will be worn by all radiography personnel.
- Note:** Radiography personnel at permanent radiography installations where other appropriate alarming or warning devices are in use need not have an alarming ratemeter.
- AND
- ☐ Pocket dosimeters and alarm ratemeters will be checked for correct response at intervals not to exceed 12 months.
- AND/OR
- ☐ If adjustment is necessary, the devices will be returned to the manufacturer.
- OR
- ☐ If adjustment is necessary, in-house procedures for adjustments are described.

**Note:** To obtain a copy of the NIST Publication 810, '*National Voluntary Laboratory Accreditation Program, 1997 Directory*', contact the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9225. (For information on the program call NIST at 301-975-3679). Also NVLAP maintains a directory of accredited laboratories on the Internet which is updated quarterly. The URL for NVLAP's home page on the internet is <http://ts.nist.gov/nvlap>.

## Item 10.7: Public Dose

**Rule:** *HFS 157.03; HFS 157.23(1) & (2); HFS 157.28(1)*

**Criteria:** Licensees must do the following:

- Ensure that radiography devices will be used, transported, and stored in such a way that members of the public will not receive more than 1 mSv (100 mrem) in a year, and the dose from licensed operations in any unrestricted area will not exceed 0.02 mSv (2 mrem) in any one hour; and
- Control and maintain constant surveillance over devices that are not in storage and secure stored devices from unauthorized removal or use.

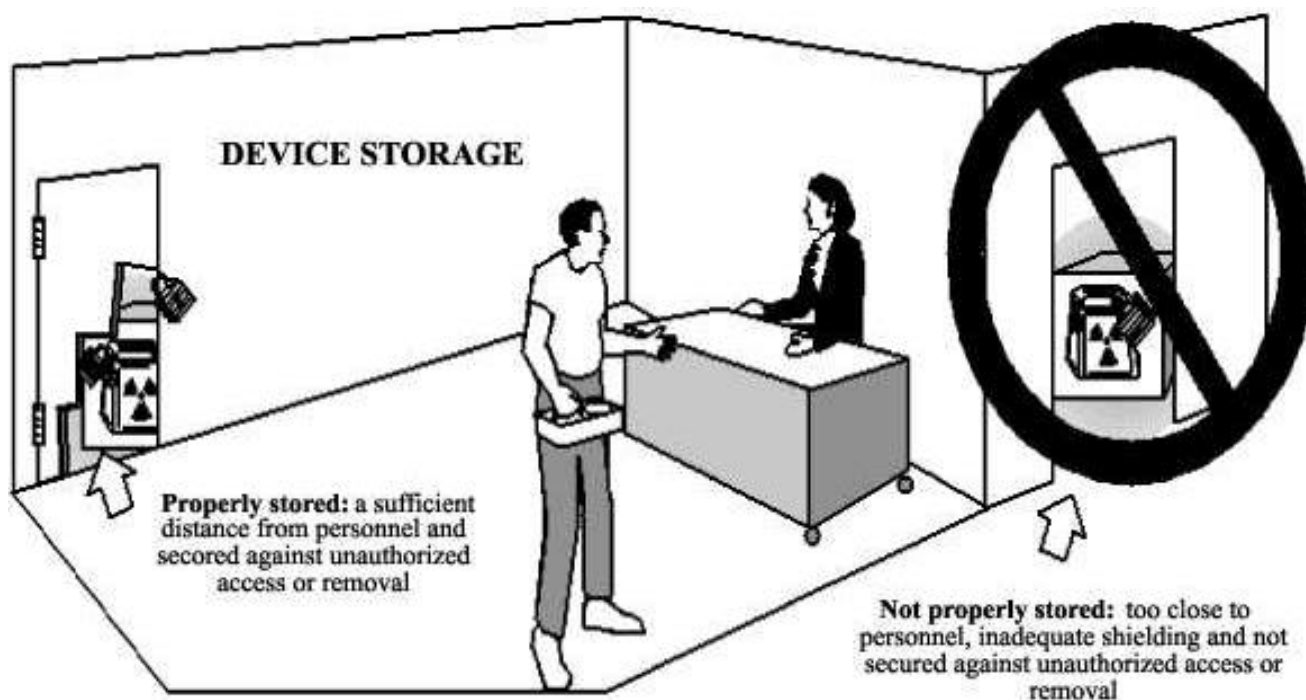
**Discussion:** Operating and emergency procedures that address security and surveillance should be sufficient to limit exposure of the public during use and after accidents. Public dose is controlled, in part, by ensuring that devices not in use are stored securely (e.g., stored in a locked area) to prevent unauthorized access or use. If devices are not in storage, then authorized users must maintain constant surveillance.

Public dose is also affected by the choice of the permanent radiographic installation and storage locations and conditions, as illustrated in **Figure 6** below. Since radiation levels around a permanent radiographic installation or storage area will vary based on the type and strength of sources used, the frequency of use, and scatter radiation from radiographic operations, it is not sufficient to perform surveys with portable survey meters to determine the annual public dose. Use of area monitors such as environmental TLD is an acceptable means of demonstrating compliance with the annual limit of 1 mSv (100 mrem) in unrestricted areas.

Use the concepts of time, distance, and shielding when choosing a permanent radiographic installation or storage location. Decreasing the time spent near radiographic operations, increasing the distance of the device from occupied locations, using shielding material (i.e., high density concrete, solid block, or lead sheets), and implementing conservative operating procedures (i.e., use of collimators or limiting the direction of exposures towards the floor) will reduce the radiation exposure of personnel and members of the public. Alternatively, the remote location of and access to a permanent radiographic installation could prevent members of the public from receiving 1 mSv (100 mrem) in a year.

If, after an initial evaluation, a licensee makes changes affecting the permanent radiographic installation storage area (e.g., changing the location of devices within the storage area, removing shielding, adding devices, changing the occupancy of adjacent areas, moving the storage area to a new location), then the licensee must

perform a new evaluation to ensure that the public dose limits are not exceeded and devices are properly secured.



**Figure 6: Storing Devices.** Devices must be stored away from occupied areas and secured against unauthorized removal.

**Response from Applicant :**

**Item 10.7 Public Dose**

No response is required, in this license application, however the licensee's evaluation of public dose will be examined during an inspection.

**Note: Appendix L** provides additional information for determining that radiation doses for other licensee personnel and members of the public will not be exceed allowable limits.



## Item 10.8: Quarterly Maintenance

**Rule:** *HFS 157.14; HFS 157.41; HFS 157.45(7); HFS 157.96(6)*

**Criteria:** The licensee shall have written procedures for inspecting and maintaining radiographic exposure devices, source changers, associated equipment, transport and storage containers, and survey instruments. Inspection and maintenance must be conducted at intervals not to exceed every 3 months, or before the first use thereafter, to ensure the proper functioning of components important to safety. The licensee must also have procedures necessary to maintain the Type B packaging used to transport radioactive materials, ensure that Type B packages are shipped properly, and maintain Type B packages in accordance with the Certificate of Compliance (COC) issued by NRC or other agencies approving such transport packages.

If equipment problems are found, the equipment must be withdrawn from service until repaired, records are required.

**Discussion:** These procedures are intended to allow the licensee's staff to evaluate equipment used in radiography for safe continued use, to provide a record of this evaluation, and to guide the staff in maintenance. Equipment found to be unsuitable for service must be withdrawn until repair and an evaluation for return to service is made. These procedures may be based on the manufacturer's recommendations. The procedures are to be specific to the equipment. For example, radiography drive cable assemblies should be cleaned and lubricated (when operationally appropriate) in accordance with the recommendations of the equipment manufacturer or the cable manufacturer or alternatively, with any lubrication and cleaning recommendations established by the industrial radiography community.

Procedures are also required for Type B packaging used to transport radioactive materials. These procedures are to be used for shipping and maintenance, and may be properly drawn from the manufacturer's procedures and information submitted as a basis for the COC or other transport package approval.

### Response from Applicant:

#### Item 10.8 Quarterly Maintenance (Check both boxes)

☐ We have included procedures for quarterly maintenance as part of the operating and emergency procedures.

AND

☐ Before using a new sealed source/device combination, we will have written inspection and maintenance procedures that address the use of new equipment as a Type B transport package. In addition, we will provide training to radiographic personnel before using a new sealed source/device combination.

## Item 10.9: Operating and Emergency Procedures

**Rule:** *HFS 157.13(6); HFS 157.44(4)*

**Criteria:** Operating and emergency procedures must be established and submitted to DHFS as part of the application package. In addition, if radiographers will perform other operations such as source exchange, leak-testing, and quarterly (not to exceed 3 months) inspection and maintenance of equipment, appropriate procedures and instructions for these operations should be included in the operating and emergency procedures.

Each licensee must develop, implement, and maintain operating and emergency procedures containing the following elements:

- Instructions for maintaining security during storage and transportation;
- Instructions to keep radiography devices under control and immediate surveillance during use;
- Steps to take to keep radiation exposures ALARA;
- Steps to maintain accountability during use;
- Steps to control access to work sites;
- Use of personnel monitoring and radiation survey equipment;
- Instruction for packaging and transporting licensed material; and
- Steps to take and whom to contact when an emergency occurs.

**Discussion:** The purpose of operating and emergency procedures is to provide radiography personnel with specific guidance for all operations they will perform. These topics should be included in the operating and emergency procedures and need not be presented in order of importance. A sequential set of procedures and instructions from the beginning to the end of the workday is an acceptable format. Instructions for non-routine operations, for example, quarterly (not to exceed 3 months) inspection and maintenance or instrument calibration, may be included as separate appendices.

It is not necessary for operating and emergency procedures to be specific to a particular make and model of exposure device, source exchanger, or survey instrument. Procedures submitted to DHFS should provide sufficient guidance and instruction for each specific type of device. For example, you may submit a single operating procedure for crank-out regardless of the manufacturer and/or a single operating procedure for pipeliner exposure devices regardless of manufacturer.

Applicants who plan to conduct lay-barge, offshore platform, or underwater radiography are required to have

their procedures approved by DHFS. If you plan to conduct lay-barge, offshore platform or underwater radiography, your radiation safety program will be reviewed to assure that it contains procedures that specifically address:

- Transport of licensed material;
- Storage facilities for licensed material;
- Methods for restricting access to radiation areas;
- Radiation safety procedures and radiographer responsibilities unique to lay-barge, offshore platform, or underwater radiography;
- Radiographic equipment and radiation safety procedures unique to underwater radiography;
- Methods appropriate for use of equipment in water environments;
- Applicable inspection and maintenance procedures unique to lay-barge, offshore platform, or underwater radiography equipment; and
- Emergency procedures unique to lay-barge, offshore platform, or underwater radiography.

Operating and emergency procedures must be submitted to DHFS for review.

Note that providing specific operating and emergency procedures for a particular manufacturer's make and model number will require an amendment to the license to obtain DHFS's authorization for a new sealed source/device combination.

### **Item 10.9.1: Handling and Use of Sealed Sources and Radiography Exposure Devices**

**Rule:** *HFS 157.44(4)*

**Criteria:** Licensees need to establish operating and emergency procedures.

**Discussion:** There are two types of devices normally used for radiography, crankout, and pipeliner. There should be separate instructions for each type of device. Separate instructions are not necessary for each different model of a given type of device since the operation of each type is essentially the same regardless of the manufacturer. Some applicants may choose to use one basic instruction for all crankout devices; others may choose to have separate instructions for each model. Either approach is acceptable.

Specific procedures should be required for performing source exchanges, including those at temporary jobsites, field stations, and in a permanent radiographic installation. The procedures should contain warnings of areas of concern during source exchanges. Recent incidents of sources becoming dislodged from the shielded position indicate the importance of training personnel in the appropriate techniques. Procedures should require the use of survey instruments, dosimetry, and surveys during and after movement of sources.

**Response from Applicant :**

**Item 10.9.1 Handling And Use Of Sealed Sources And Radiography Exposure Devices** (Check one box)

- ☐ We will include the following in the operating and emergency procedures:  
Step-by-step instructions for using each type of radiographic devices;  
Instructions for performing source exchanges; and  
Instructions for crankout devices should be separate from those for pipeliner devices.

**Note:** Manufacturers' manuals and similar documents should not be incorporated into the procedures, rather, information should be extracted from them and paraphrased.

**Appendix M** provides information for applicants to consider when developing their procedures for operating radiography equipment.

**Item 10.9.2: Methods and Occasions for Conducting Radiation Surveys**

**Rule:** *HFS 157.23(2); HFS 157.29(6); HFS 157.36(1)(a); HFS 157.37(1); HFS 157.39; HFS 157.44(7); HFS 157.94(1)(j)*

**Criteria:** Perform radiation surveys during use, movement, and storage of licensed material to ensure its safe use and comply with regulatory requirements.

**Discussion:** In general, surveys need to be made whenever a source is manipulated or moved. Surveys should be made with a radiation survey instrument calibrated in accordance with *HFS 157.38*. The following table provides examples of surveys, made during radiographic and associated operations that should be included in the operating and emergency procedures.

**Table 6: Surveys Required for Radiographic Operations**

<b>Type of Radiation Survey</b>	<b>Frequency</b>	<b>Requirement</b>
Boundary of restricted area at temporary jobsite does not exceed 0.02 mSv (2 mrem) in any one hour	During the first exposure for each set up of radiographic device	<b>HFS 157.23(2)</b>
Unrestricted area in vicinity of permanent radiographic installation or storage area does not exceed 1 mSv (100 mrem) per year	At intervals not to exceed 12 months	<b>HFS 157.23(2)</b>
External radiation levels when a package is received and opened	Each receipt of package	<b>HFS 157.29(6)</b>
Exposure rate does not exceed 2 mSv/hr (200 mrem/hr) on surface and 0.1 mSv/hr (10 mrem/hr) at one meter	Each installation of new source in exposure device	<b>HFS 157.36(1)(a)</b>
Exposure rate does not exceed 2 millisieverts (200 millirem) per hour at any exterior surface, and 0.1 millisieverts (10 millirem) per hour at 1 meter from any exterior surface with the sealed source in the shielded position.	Each installation of new source in a storage container or source changer	<b>HFS 157.37(1)</b>
Contamination level for leak tests of sealed sources does not exceed 185 Bq (0.005 microcuries)	At intervals not to exceed 6 months	<b>HFS 157.39</b>
Contamination level for leak test of S tube of exposures device does not exceed 185 Bq (0.005 microcuries)	At intervals not to exceed 12 months	<b>HFS 157.39</b>
Confirm source has returned to a shielded position	After every radiographic exposure	<b>HFS 157.44(7)</b>
Confirm source is in shielded position	After every source exchange or exposure device is placed in storage	<b>HFS 157.44(7)</b>
Exposure rates meet labeling of package (i.e., Yellow II) and determine Transportation Index	Every movement of licensed material on public roads	<b>HFS 157.94(1)(j)</b>
Exposure rates in and around vehicle do not exceed 0.002 mSv/hr (2 mrem/hr) in driver's seat, 2 mSv/hr (200 mrem/hr) on surface and 0.1 mSv/hr (10 mrem/hr) at 2 meters from vehicle	Every movement of a package labeled Yellow III	<b>HFS 157.94(1)(j)</b>

**Response from Applicant :**

**Item 10.9.2 Methods And Occasions For Conducting Radiation Surveys** (Check box)

- ☐ We have included in the operating and emergency procedures all surveys as described in the section titled 'Methods And Occasions For Conducting Radiation Surveys ' in WISREG 'Guidance for Industrial Radiography Use'.

### **Item 10.9.3: Methods for Controlling Access to Radiographic Areas**

**Rule:** *HFS 157.28(1); HFS 157.29(2); HFS 157.42; HFS 157.44*

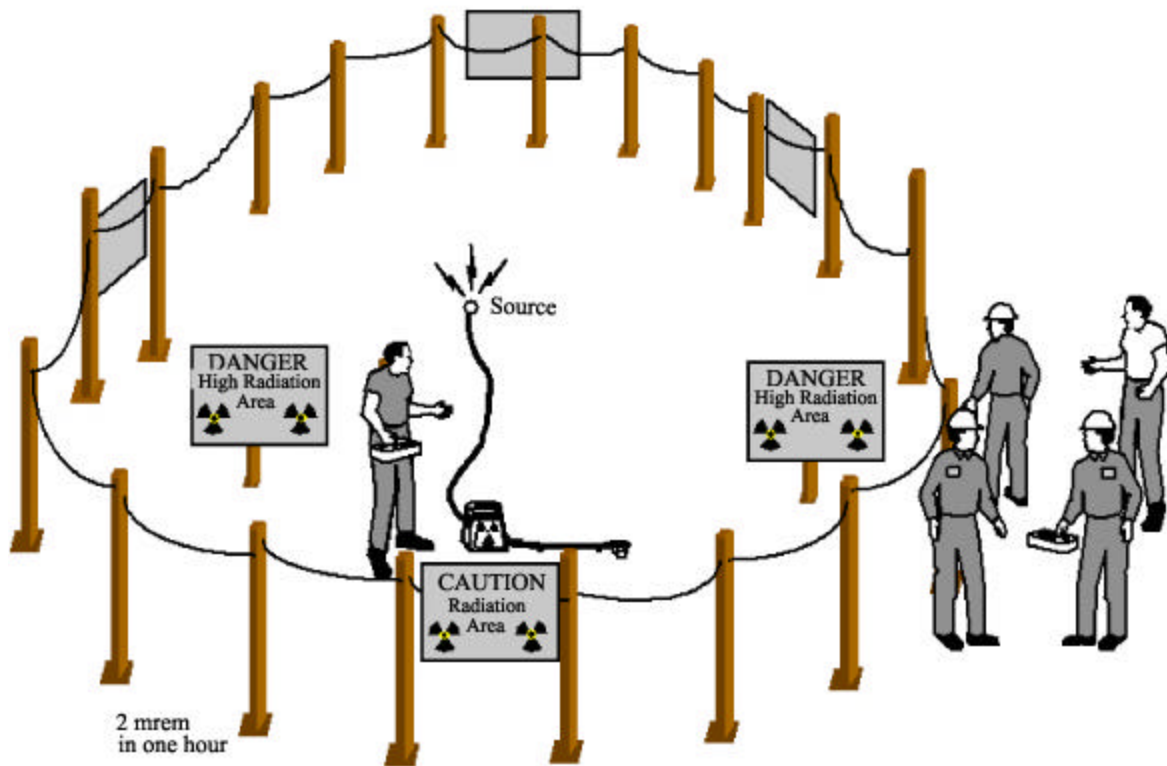
**Criteria:** Each licensee must control access to areas where licensed material is either used or stored to prevent the unnecessary exposure of members of the public. This can be achieved through the use of posting, by locking devices and areas where licensed materials are stored, and by maintaining constant control and continuous surveillance of areas where radiographic operations are conducted. Operating and emergency procedures should include steps for radiographic personnel to ensure that access to licensed materials is controlled for the types of operations that will be performed.

#### **Discussion:**

##### **1. Field/Temporary Jobsites**

When radiographic operations are performed outside a permanent radiographic installation, at least two qualified radiographic personnel must be present. At least one of the individuals must be a radiographer; the other may be another radiographer or a radiographer's assistant. Both individuals must maintain constant surveillance of the operations to prevent unauthorized entry to the restricted area. Operating procedures must comply with the two-man rule for radiographic operations at any locations other than permanent radiographic facilities.

Radiographic personnel are required to maintain continuous direct visual surveillance of operations to protect against unauthorized entry to the high radiation area during radiographic operations. Radiographic personnel should be instructed to keep the perimeter of the restricted area under continuous surveillance to prevent unnecessary exposure of individuals. Operating procedures should specify steps for responding to unauthorized entry to the restricted area. For example, personnel should be instructed to terminate the radiographic exposure immediately, before confronting the person who entered the restricted area.



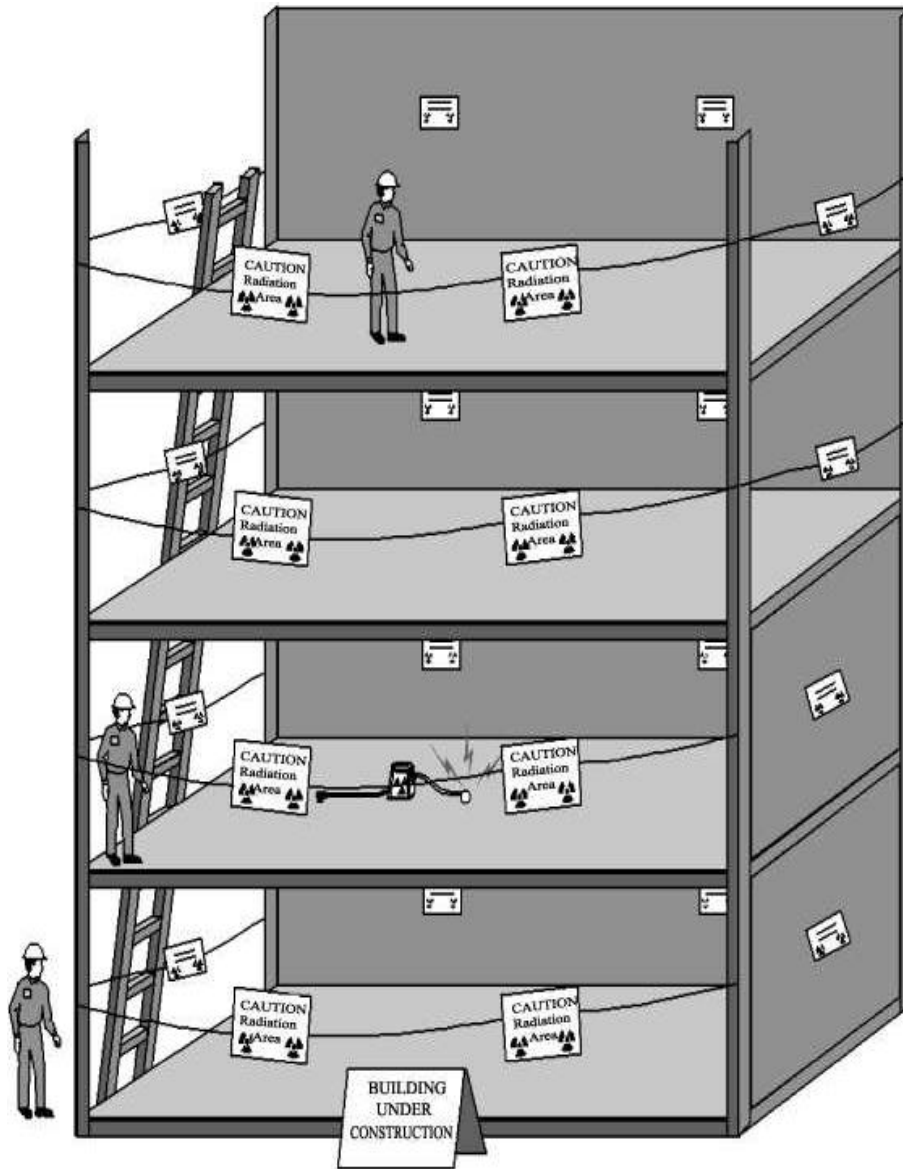
**Figure 7: Posting:** A radiographer is likely to use only a single rope barrier. The radiation area and restricted area would be combined into one and located at the 2 mrem in any 1-hour boundary.

All areas where radiographic operations are conducted require posting of the radiation areas and the high radiation areas as shown in **Figure 7**. It is acceptable to post the perimeter of the restricted area rather than the perimeter of the radiation area. Personnel should be instructed to post "Caution Radiation Area" signs at the point where radiation levels have been calculated to reach 0.02 mSv (2 mrem) in any one hour. A confirming survey during the first exposure of the source should be conducted to confirm the location of the boundary and any necessary adjustments should be made.

The perimeter of the high radiation area must be posted with a "Caution (or Danger) High Radiation Area" sign(s) at the point where radiation levels have been calculated to reach 1 mSv (100 mrem) in any one hour. A confirming survey of the high radiation area perimeter should not be conducted, since such a survey could lead to unnecessary exposure of personnel.

Surveillance of the restricted area at facilities with multiple levels and multiple access points, or where members of the public are close to the radiographic operations (e.g., boilers, commercial manufacturing plants, or power plants during outages) can usually be performed only when more than two radiographic personnel are assigned to the job. **Figure 8** below provides one example of such a temporary jobsite. Operating procedures

and instruction to personnel should include specific steps for these circumstances to ensure that access into the restricted area is properly controlled. These special instructions may include the use of additional personnel to assist radiographic personnel in controlling access into the restricted area, providing instruction to other workers in the area, or making announcements over the public address system before and during radiographic operations.



**Figure 8: Surveillance and Posting at a Temporary Job Site with Multiple Floors and Access Points.** Adequate control of the restricted area at this type of job site requires several personnel and many postings.



## **2. Permanent Radiographic Installations**

For permanent radiographic installations, instruct personnel about posting each entrance to the facility with a "Caution (or Danger) High Radiation Area" sign(s), and provide procedures to ensure that the visible-audible signal system is operable. The operability of the visible-audible system must be checked daily. The following procedures may be used:

- Expose a radiation source in the permanent installation with all entrances closed;
- Determine that each visible signal in and outside the installation is functional;
- Open the door to each entrance into the installation to activate the audible alarm;
- Close the entrance and confirm that the alarm stops. If the installation has more than one entrance, only one entrance should be tested at a time; and
- Record results of test.

In the event that an entrance control device or an alarm fails to operate properly at the permanent radiographic installation, the installation may continue to operate for up to 7 days while the defective equipment is fixed, provided that:

- The entrance control device is labeled as defective;
- Radiography personnel maintain continuous, direct, visual surveillance of access installation points;
- Radiography personnel use an alarming rate meter.

## **3. Storage Areas**

Radiographic equipment containing licensed materials stored in controlled or unrestricted areas must be secured from unauthorized removal or access. Operating procedures should specify how stored licensed materials should be secured and who is authorized access to licensed material.

A vehicle used to transport licensed material can also be used for storage at locations such as temporary jobsites or overnight lodging. If the applicant plans to use vehicles for storage, there should be procedures and instructions to personnel about proper posting of the vehicle. Vehicles should be posted with a "Caution - Radioactive Material" sign on the entrance to the area of the vehicle where licensed material is stored. A physical survey should be performed to confirm that the area around the storage facility is an unrestricted area. Radiation levels may not exceed 0.02 mSv/hr (2 mrem/hr) at 18 inches (45 cm) from any external surface of the vehicle and the vehicle shall be locked when it is used for storage.

Radiographic equipment stored at temporary jobsites must be secured at a location that prevents access by unauthorized personnel. This usually requires that the equipment be locked in a cabinet or other secure area where key access is controlled by site management and radiographic personnel. It is not acceptable for a device to be chained to a post and left unattended at the place of use during lunch, breaks, or after hours. Storage of exposure devices at a private residence is unacceptable unless it has been identified and approved in a license.

**Response from Applicant :**

**Item 10.9.3 Methods For Controlling Access To Radiographic Areas** (Check box)

- ☐ We have included procedures to control access to radiographic operations and storage areas in the operating and emergency procedures

**Note:** All regulatory criteria applying to your normal place of business for conducting industrial radiography operations also apply to the location in which you store at your private residence. You must specify this storage location in you license application.

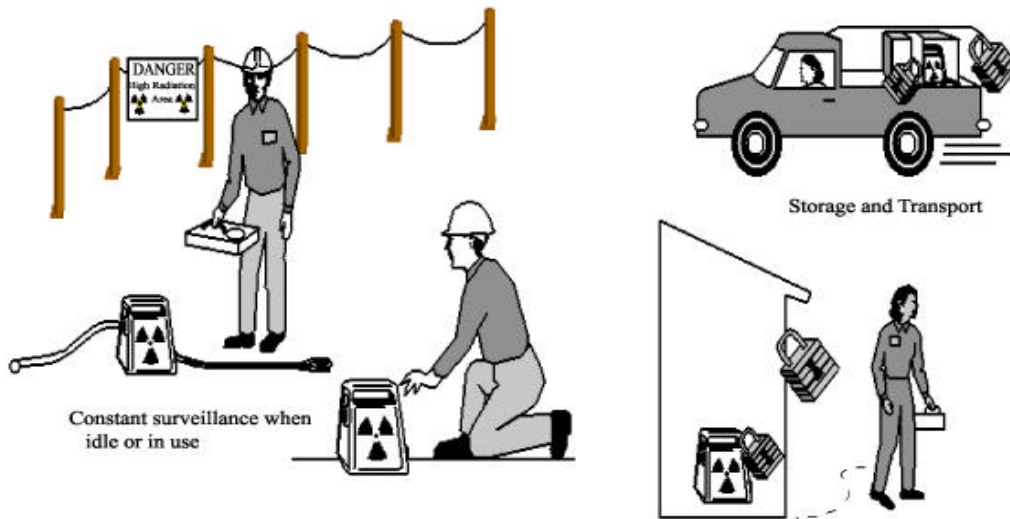
**Item 10.9.4: Methods And Occasions For Locking And Securing Radiographic Exposure Devices, Storage Containers, And Sealed Sources**

**Rule:** *HFS 157.36; HFS 157.37(2)*

**Criteria:** Chapter HFS 157 ‘Radiation Protection’ requires locking and securing radiographic equipment to protect the public and radiographers from an inadvertent exposure to radiation.

**Discussion:** All radiographic devices, i.e., gamma cameras, sealed source storage containers, and source changers are required to have a lock or outer-locked container to maintain the sealed source in its shielded position. During radiographic operations the source must automatically be secured in the shielded position each time the source is returned. Radiographers must not attempt to circumvent the automatic securing features or tamper with the safety features of radiographic devices. As shown in **Figure 9** below radiographers must never leave the exposure device at the temporary jobsite without securing it properly from unauthorized removal or tampering. Radiographers and/or radiographer’s assistants must ensure that the exposure device and/or storage or source containers are maintained locked (and if key locked, with the key removed at all times) when they are not under the direct supervision of the radiographer or the radiographer’s assistant, except at permanent radiographic installations.

## Security



**Figure 9: Security.** To avoid lost or stolen devices, licensees must keep the devices under constant surveillance, or secured against unauthorized use or removal.

### Response from Applicant :

#### Item 10.9.4 Methods And Occasions For Locking And Securing Radiographic Exposure Devices, Storage Containers, And Sealed Sources (Check box)

☐ We have included procedures for locking and securing radiographic equipment in the operating and emergency procedures

## 10.9.5: Personnel Monitoring And The Use Of Personnel Monitoring Equipment

**Rule:** *HFS 157.25(1); HFS 157.25(2); HFS 157.44(6)*

**Criteria:** Provide procedures for appropriate use of personnel monitoring equipment.

**Discussion:** As shown in **Figure 10** below, all radiographers or radiographers' assistants are required to wear:

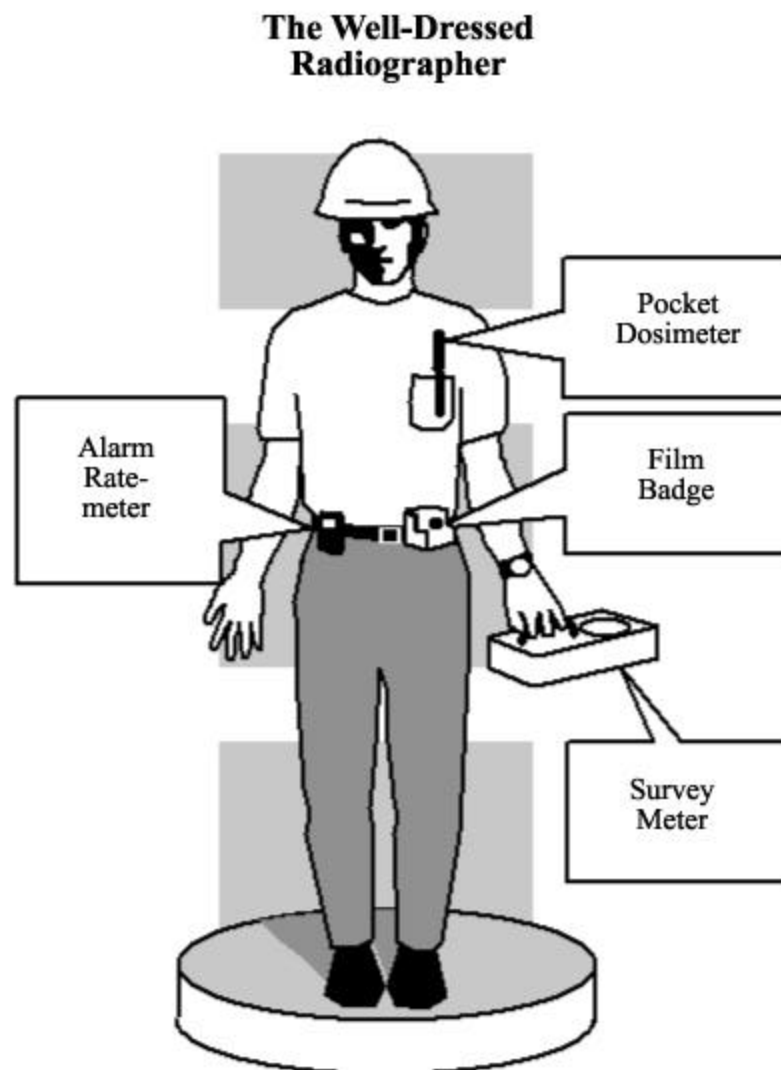
- Direct-reading dosimeters, and film badges, TLDs or similar devices; and
- Alarm ratemeters when they are engaged in radiographic operations.

Film badges, TLDs or similar devices must be assigned to and worn by only one individual. To ensure full-

scale reading capability, direct reading dosimeters such as pencil (pocket) dosimeters or electronic personal dosimeters must be recharged or reset at the start of each shift so that the dosimeters will be capable of reading the full scale. Personnel should be instructed that direct reading dosimeters must be read and recorded at the beginning and end of each shift. Proper operation of alarm ratemeters must be checked each day before use to ensure that the alarm functions properly. The manufacturer's recommended procedures should be followed.

All radiographers or radiographers' assistants are required to wear alarm ratemeters except at permanent radiographic facilities where other appropriate alarm or warning devices (e.g., visible and audible alarms) are in routine use and are operable.

Include instructions about how and where dosimetry devices are to be stored when not in use. The storage place should be dry, radiation free, and cool so that the devices will not be affected by adverse environmental conditions.



**Figure 10: The Well-Dressed Radiographer**

## Response from Applicant:

### Item 10.9.5 Personnel Monitoring And The Use Of Personnel Monitoring Equipment (Check box)

☐ We have included instructions for proper use of personnel monitoring equipment in the operating and emergency procedures

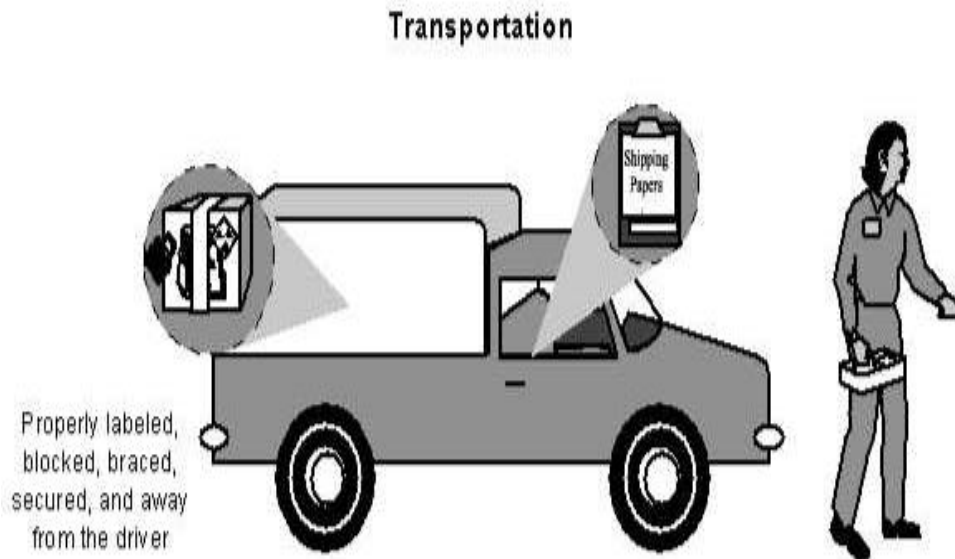
**Note:** It is good practice to check the dosimeter during the work shift.

## 10.9.6: Transporting Sealed Sources To Field Locations, Securing Exposure Devices And Storage Containers In Vehicles, Posting Vehicles, And Controlling Sealed Sources During Transportation

**Rule:** *HFS 157.92(3)*

**Criteria:** Licensees must develop, implement, and maintain procedures for transporting radioactive material to ensure compliance with DOT regulations.

**Discussion:** **Figure 11** below illustrates some often-overlooked DOT requirements. During an inspection, DHFS uses the provisions of *HFS 157.92(3)* which incorporates the requirements of 49 CFR, to examine and enforce transportation requirements applicable to radiography licensees. **Appendix N** contains: 1) a list of major DOT regulations applicable to transporting radiographic devices; 2) a condensed summary of DHFS/DOT requirements; and 3) two sample shipping papers, the second of which may be more useful for multiple-use, temporary jobsite activities.



**Figure 11: Transportation.** Licensees often transport their radiographic devices to and from sites and must ensure compliance with Department of Transportation regulations.

Instructions to personnel should not reference DHFS/DOT requirements. Information should be extracted, paraphrased and placed into the instructions so that personnel know exactly what they are expected to do. The following items should be covered in instructions to personnel:

- Labeling containers appropriately (i.e., when to use labels Radioactive White I, Radioactive Yellow II, or Radioactive Yellow III);
- Securing the exposure device or storage container within the transporting vehicle. The instructions should specify how to prevent the package from moving during transport;
- Preparation of shipping papers. The instructions should specify that the papers must be completed before transporting the licensed material and must be accessible in the driver's compartment at all times. **Appendix N** contains examples of shipping papers for transporting radiographic exposure devices;
- Placarding both sides, the front, and the back of the vehicle with "RADIOACTIVE" placards if the package being transported requires a Radioactive Yellow III label. If the vehicle requires placarding and the package radiation levels exceed 2 mSv/hr (200 mrem/hr) or the transport index exceeds 10, exterior surfaces and passenger compartment of the vehicle must be surveyed to ensure that the radiation levels do not exceed 0.02 mSv/hr (2 mrem/hr) from any exterior surface and 0.02 mSv/hr (2 mrem/hr) in the passenger compartment. Include instructions to personnel on the measures to take if the radiation level exceeds 0.02 mSv/hr (2 mrem/hr) in the passenger compartment (e.g., adding more shielding or repositioning the device within the vehicle);

- Ensure that the licensee's name and city/town is prominently displayed as a label on both sides of the vehicle; and
- If an exposure device is transported in an overpack, the procedures should include instructions that the overpack must be properly marked with the shipping name and identification number, labeled (Radioactive White I or Radioactive Yellow II), and marked when required with a statement that indicates the inner package complies with prescribed specifications.

Because the licensee may have authorization to possess and use several sealed source/device combinations that are registered by the NRC or an Agreement State and meet the safety performance requirements of *HFS 157.36*, the applicant must, before using a new sealed source/device combination, develop written inspection and maintenance procedures for it and for the corresponding Type B transport package. In addition, the applicant must provide adequate training for radiographic personnel before using a new sealed source/device combination.

## Response from Applicant

### Item 10.9.6 Transporting Sealed Sources To Field Locations, Securing Exposure Devices And Storage Containers In Vehicles, Posting Vehicles, And Controlling Sealed Sources During Transportation (Check one box)

- ☐ We have included procedures for transporting sealed sources containing radioactive material, exposure devices, and source changers in the operating and emergency procedures
- OR
- ☐ Not Applicable (Devices are not transported)

**Note:** 'A Review of Department of Transportation Regulations for Transportation of Radioactive Materials (1998 revision)' can be obtained by calling DOT's Office of Hazardous Material Initiatives and Training at (202) 366-4900 or by accessing their website at <http://hazmat.dot.gov/pubtrain/ramreview.pdf>.

Before the 1997 revision of **10 CFR Part 34**, a licensee who intended to transport a radiographic Type B package was required to submit a quality assurance program to NRC for approval, separate from the license approval. The 1997 revision to **10 CFR Part 34** requires written procedures for inspection and maintenance of radiographic Type B packages (*10 CFR 34.31(b)*). In conjunction with the revision to **10 CFR Part 34**, the NRC also amended *10 CFR 71.101(g)* to specifically state that if the applicant's written procedures for inspection and maintenance of radiographic Type B packages are approved, then the applicant also meets NRC quality assurance requirements in **10 CFR Part 71** and does not have to submit or maintain a separate quality assurance program to transport a Type B package. The application's inspection and maintenance procedures for radiographic equipment, which are also used for

Type B packages, should ensure that these packages are shipped and maintained in accordance with their COC.

### **Item 10.9.7: Daily Inspection and Maintenance of Radiographic Equipment**

**Rule:** *HFS 157.41; HFS 157.42; HFS 157.44(4), (6) & (7); HFS 157.45(7); HFS 157.45(11)*

**Criteria:** The licensee shall perform visual and operability checks before using radiography equipment on each day it is used.

**Discussion:** Visual and operability checks must be performed on radiographic exposure devices, survey meters, associated equipment, and transport and storage containers before use each day the equipment is used. These checks are intended to ensure that the equipment is in good working condition, that the sources are adequately shielded, and that required labeling is present. Licensees must check survey instrument operability using check sources or other appropriate means.

Inspection records shall contain information about equipment problems found in daily checks and quarterly (not to exceed 3 months) maintenance inspections. Records shall include the date of check or inspection, name of inspector, equipment involved, any problems found, and what repair and/or maintenance, if any, was done.

Instructions to personnel using radiographic equipment must clearly state that inspections are to be made before the equipment is used each day. While not a requirement, good practice would be that if the equipment is used on more than one shift in the day, the equipment should be inspected before the start of each shift.

The procedures should specify the items that are to be checked and the steps that are to be taken if any defects are found. If problems are found, the equipment must be removed from service until it is repaired.

A list of items that should be checked in the daily inspection of radiography equipment can be obtained by contacting the equipment manufacturers.

Permanent radiographic installation visible and audible alarms must be checked for operability daily before use, and faulty radiographic equipment must be labeled and repaired within 7 days, with compensatory measures taken in the interim. Compensatory measures taken include:



- Immediately label faulty equipment as defective;
- The radiographer must be accompanied by at least one other radiographer or radiographer's assistant;
- Continuous surveillance requirements are implemented until repairs are completed;
- Alarming ratemeters shall be worn and checked for alarm function at the beginning of each shift; and
- Records must be maintained of faulty equipment.

**Appendix O** provides example instructions for daily inspection of radiographic devices and equipment.

**Response from Applicant :**

**Item 10.9.7 Daily Inspection And Maintenance Of Radiography Equipment** (Check box)

- ☐ We have included procedures for daily inspection and maintenance of radiography equipment in our operating and emergency procedures.

**Note:** Direct reading dosimetry devices must be read and the exposures recorded at the beginning and end of each shift. Alarm ratemeters shall be checked for alarm function at the beginning of each shift. Records are to be maintained

## **10.9.8: Ratemeter Alarms Or Off-Scale Dosimeter Readings**

**Rule:** *HFS 157.44(3), (4) & (6)*

**Criteria:** Licensees must instruct personnel in:

- Appropriate handling and use of sealed radioisotope sources and radiography devices;
- Methods and occasions for conducting radiation surveys, controlling access to radiation areas and locking, securing, and transporting storage containers, radiographic exposure devices, and sealed radioisotope sources;
- The operating and emergency procedures;
- Actions to be taken if a dosimeter shows an off-scale reading or an alarm ratemeter alarms (sounds, etc.) unexpectedly;
- Procedures to be followed if a film badge, TLD or similar device is lost or damaged; and
- Procedures for notifying the proper persons in the event of an accident.

**Discussion:** If an individual's self-reading pocket dosimeter is found to be off scale, an individual's electronic personal dosimeter reads above 2 mSv (200 mrem), or a ratemeter alarms (sounds, etc) unexpectedly, the RSO or designee must be notified immediately. If radiation exposure cannot be ruled out by the RSO or designee as the root cause, the individual's film badge, TLD or similar approved device must be sent for processing within 24 hours. The affected individual may not resume work with radioactive material until the RSO or designee has determined the individual's radiation exposure. **There are no exemptions to this requirement.**

If any of the events described above should occur, personnel should be instructed to do the following at a minimum:

- Stop work immediately, ensure that the source is in the safe storage position in the exposure device, and vacate the radiation area;
- If the ratemeter alarms (sounds, etc.), evaluate pocket dosimeter reading;
- Notify the individual specified in the emergency procedures;
- Notify the RSO or designee of the problem;
- If pocket dosimeter is off scale, do not resume operations until authorized by the RSO or designee; and
- If the exposure cannot be ruled out by the RSO or designee, then the film badge or TLD must be processed within 24 hours.

**Response from Applicant :**

**Item 10.9.8 Ratemeter Alarms Or Off-Scale Dosimeter Readings** (Check box)

☐ We have addressed ratemeter alarms or off-scale dosimeters in the operating and emergency procedures

### **Item 10.9.9: Procedure For Identifying And Reporting Defects And Non-compliance**

**Rule:** *HFS 157.13(17); HFS 157.46*

**Criteria:** Licensees must notify management if defects are found in radiography equipment.

**Discussion:** Equipment defects that cause a substantial safety hazard, or equipment failures involving DHFS-regulated activities, must be reported to DHFS. For example, a failure of the coupling between the source assembly and the control cable must be reported to DHFS. Radiography personnel should be instructed to

report any malfunction or defect in radiography equipment to management, so that management can take appropriate action.

**Response from the Applicant:**

**Item 10.9.9 Procedure For Identifying And Reporting Defects And Non-Compliance** (Check box)

☐ We have included procedures for notifying management of equipment malfunction or defect in the operating and emergency procedures

**Note:** See NRC IN 91-39 ‘*Compliance with 10 CFR part 21, Reporting of Defects and Non-compliance*’. This is available from the NRC website at [www.nrc.gov](http://www.nrc.gov).

**Item 10.9.10: Notification Of Proper Persons In The Event Of An Accident**

**Rule:** *HFS 157.13(17); HFS 157.32(1), (2) & (3); HFS 157.44(4); HFS 157.46*

**Criteria:** Operating and emergency procedures must ensure that appropriate notifications are made during and after an emergency.

**Discussion:** The emergency procedures should clearly identify the names and telephone numbers of the RSO or other persons who can provide assistance in an emergency or accident. Such persons may also include the exposure device manufacturer, DHFS and local agencies. The emergency procedures shall always be available to radiography personnel during radiography and up-to-date.

DHFS rules also require immediate notification upon the discovery of certain events. Notify DHFS when radiographic devices are lost or stolen or if there is indication of overexposure. Refer to the rule stated above or to **Appendix P** for additional guidance in the preparation of emergency procedures. **Table 7** below provides a description of events that require notification and/or reports.

**Table 7: Notification in the Event of an Accident**

<b>EVENT</b>	<b>TEL. NOTIFICATION</b>	<b>WRITTEN REPORT</b>	<b>RULE</b>
Fire, explosion or toxic gas release	Immediate	30 days	<i>HFS 157.13(17)(a)</i>
Unplanned contamination event	24 hours	30 days	<i>HFS 157.13(17)(b)</i>
Equipment is disabled or fails to function as designed	24 hours	30 days	<i>HFS 157.13(17)(b)</i>
Theft or loss of material	Immediate	30 days	<i>HFS 157.32(1)</i>
Whole body dose greater than 0.25 Sv (25 rems)	Immediate	30 days	<i>HFS 157.32(2)(a)</i>
Extremity dose greater than 2.5 Sv (250 rems)	Immediate	30 days	<i>HFS 157.32(2)(a)</i>
Whole body dose greater than 0.05 Sv (5 rems) in 24 hours	24 hours	30 days	<i>HFS 157.32(2)(b)</i>
Extremity dose greater than 0.5 Sv (50 rems) in 24 hours	24 hours	30 days	<i>HFS 157.32(2)(b)</i>
Whole body dose greater than 0.05 Sv (5 rems)	None	30 days	<i>HFS 157.32(3)(a)</i>
Dose to minor greater than 5mSv (500 mrem)	None	30 days	<i>HFS 157.32(3)(a)</i>
Dose to embryo or fetus of a declared pregnant woman greater than 5 msv (500 mrem)	None	30 days	<i>HFS 157.32(3)(a)</i>
Dose to individual member of public greater than 1 mSv (100 mrems)	None	30 days	<i>HFS 157.32(3)(a)</i>
Any applicable limit in the license or registration	None	30 days	<i>HFS 157.32(3)(a)</i>
Leak test of sealed source or guide tube greater than 185 Bq (0.005 Ci)	None	5 days	<i>HFS 157.32(7)</i>
Unintentional disconnection of the source assembly from the control cable	None	30 days	<i>HFS 157.46(1)</i>
Inability to retract the source assembly to its fully shielded position and secure it in its retracted position	None	30 days	<i>HFS 157.46(1)</i>
Failure of any component which is critical to safe operation of the device to properly perform its intended function	None	30 days	<i>HFS 157.46(1)</i>
An indicator on radiation machine fails to show that radiation is being produced, and exposure switch fails to terminate production of radiation when turned to the off position or a safety interlock fails to terminate x-ray production	None	30 days	<i>HFS 157.46(1)</i>
Use of licensed material at any location not on license for more than 180 days in a calendar year	Notify DHFS prior to exceeding 180 days	None	<i>HFS 157.46(3)</i>

## Response from Applicant :

### Item 10.9.10 Notification Of Proper Persons In The Event Of An Accident (Check box)

- ☐ We have included appropriate instructions in the operating and emergency procedures for notifying the RSO and/or other personnel in the event of an emergency

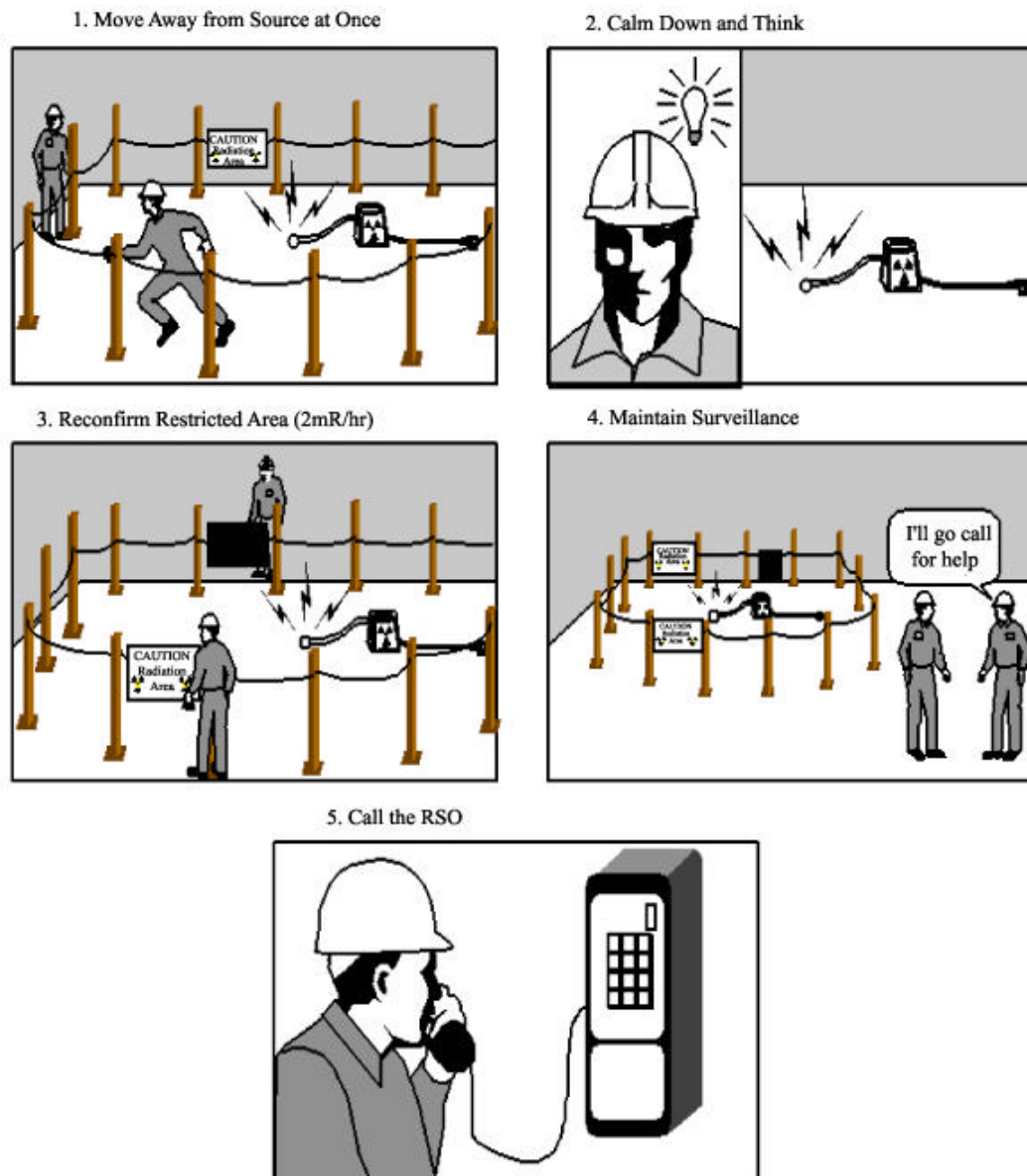
**Note:** Telephone notifications shall be made to DHFS at (608) 267-4797 during normal business hours (8 a.m. – 4:30 p.m.) DHFS's 24 hour emergency telephone number is (608) 258-0099. Identify the emergency as radiological.

### Item 10.9.11: Minimizing Exposure Of Persons In The Event Of An Accident

**Rule:** *HFS 157.44(4)*

**Criteria:** To maintain exposures as low as possible in the event of an emergency.

**Discussion:** Since it is not possible to specify all possible situations that would constitute an emergency, a general instruction is acceptable as shown in **Figure 12** below. This general instruction should describe licensee actions to maintain the dose at a minimal level after an abnormal event is identified. The instruction should include routine emergency actions such as posting the restricted area, maintaining surveillance of the restricted area, and notifying the RSO.



**Figure 12: Emergency Procedures.** These steps provide guidance in an emergency.

**Response from Applicant :**

**Item 10.9.11 Minimizing Exposure Of Persons In The Event Of An Accident (Check box)**

- ☐ We have included instructions for minimizing exposure of persons in the event of an accident in the operating and emergency procedures

## Item 10.9.12: Source Retrieval

**Rule:** *HFS 157.44(4); HFS 157.46*

**Criteria:** Each licensee who intends to perform source retrieval operations must have appropriate equipment, training, and procedures.

**Discussion:** Applicants must develop source retrieval procedures if their own radiographic personnel with appropriate training and experience will conduct source retrievals. If procedures are submitted, DHFS will review and approve applicants to perform source retrieval. If source retrieval procedures are not submitted for review, then source retrieval activities must be conducted by a licensee whose is specifically authorized for these activities by DHFS, the NRC or an Agreement State.

Licensees specifically approved to perform source retrievals will have a specific license condition authorizing these activities. In addition, these individuals are authorized to perform source retrievals for other licensees.

DHFS will review the applicant's procedures for source retrieval with respect to keeping exposures ALARA and controlling exposures to radiation. Since it is not possible to specify all potential exposure situations, a general procedure is acceptable.

A retrieval procedure should contain the following elements:

- Warnings that only specifically authorized individuals, or personnel supervised by such authorized individuals and working in their presence are allowed to perform retrievals;
- A clear statement that no source or suspected source containing items such as a stuck source in a guide tube will be handled directly;
- Expedient methods of reducing unintended exposure to staff and the public, such as using lead shot bags, sandbags, steel plates, remote handling devices, and culverts cut lengthwise;
- Additional dosimetry should be used during source retrievals, for example, pocket dosimeters with a range greater than 2 mSv (200 mrems) or finger badges;
- Methods of restricting access to the area, including establishing a restricted area and obtaining outside help in controlling access;
- Appropriate use of survey instruments. The procedure should prohibit using alarming dosimeters or electronic dosimeters as survey instrument substitutes;
- Criteria for requesting outside assistance;

- Instructions for reducing the exposure to other personnel and members of the public during recovery operations;
- Notification of the RSO/RSO-designee, and management;
- Specific training including practice with special tools, shielding, and additional dosimetry with a dummy source; and
- Notification to DHFS.

**Response from Applicant :**

**Item 10.9.12 Source Retrieval** (Check one box)

- ☐ We will not perform source retrieval and will use the services of a person specifically licensed by DHFS, the NRC or an Agreement State to perform the retrievals of our sources.
- OR
- ☐ We will perform source retrieval. We will include source retrieval procedures in the operating and emergency procedures and submit specific training for DHFS review.

**Note:** Radiography personnel should not attempt to perform operations involving retrieval or recovery unless they have actual training in retrieval operations using a dummy source with the appropriate handling tools, survey instruments, and dosimetry. Source retrieval must be specifically authorized on the license.

## **Item 10.9.13: Maintenance Of Records**

**Rule:** *HFS 157.44(4); HFS 157.45*

**Criteria:** The licensee shall meet DHFS record requirements.

**Discussion:** Personnel must generate and maintain certain records when performing radiography, including:

- Utilization logs showing the following:
  - Description, including the make, model, and serial number of the device used.
  - Identification and signature of the radiographer.
  - Where the device is used and dates of use; dates device is removed and returned to storage.
- Records of daily inspection of equipment;
- Pocket dosimeter readings. These readings must be made at the beginning and end of a work shift. Instructions to personnel must specify that the readings be recorded;



- Results of the physical survey to ensure that the sealed source is in the shielded position, when a radiographic exposure device is placed in a storage area (as defined in **HFS 157.03**) and if that survey is the last one performed in the workday.

Operations requiring records include inspections and maintenance at intervals not to exceed 3 months. Other examples include instrument calibration and shipment of packages. Radiography personnel should also be aware of the records that must be maintained at temporary jobsites listed in **HFS 157.45(14)(b)**. Radiographers performing radiographic duties should be given specific instructions for recordkeeping. These should not include instructions about records that are the responsibility of management and supervision.

### Response from the Applicant:

#### Item 10.9.13 Maintenance Of Records (Check box)

☐ We have included procedures which ensure proper maintenance of records in the operating and emergency procedures

## Item 10.10: Minimization of Contamination

**Rule:** *HFS 157.13(2)(b)*

**Criteria:** Applicants for new licenses must describe how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.

**Discussion:** All applicants for new licenses need to consider the importance of designing and operating their facilities to minimize the amount of radioactive contamination generated at the site during its operating lifetime and to minimize the generation of radioactive waste during decontamination. Industrial radiography applicants usually do not need to address these issues as a separate item since they are included in responses to other items of the application.

Sealed source and devices that are approved by the NRC or an Agreement State and located and used according to their respective SSD Registration Certificates usually pose little risk of contamination. Leak tests performed as specified in **HFS 157.39** should identify defective sources. Leaking sources must be withdrawn from use and decontaminated, repaired, or disposed of according to **Chapter HFS 157 ‘Radiation Protection’**. These steps minimize the spread of contamination and reduce radioactive waste associated with decontamination

efforts. Other efforts to minimize radioactive waste do not apply to programs using only sealed sources and devices that have not leaked.

**Note:** The applicant does not need to provide a response to this item under the following condition. DHFS will consider that the above Criteria have been met if the applicant's responses meet the criteria for the following items: 'Sealed Sources and Devices', 'Facilities and Equipment', 'Leak Tests', 'Operating and Emergency Procedures', and 'Waste Management'.

## Item 11: Waste Management

**Rule:** *HFS 157.13(15) & (18); HFS 157.30(1)*

**Criteria:** Licensed materials must be disposed of in accordance with DHFS requirements by transfer to an authorized recipient. Appropriate records must be maintained.

**Discussion:** Licensees who dispose of radiography sealed sources, or dispose of radiography devices containing depleted uranium, must transfer them to an authorized recipient. Recipients authorized to accept radioactive material are the original manufacturer of the device, or a commercial firm licensed by DHFS, the NRC or an Agreement State.

Before transferring radioactive material, a licensee must use one of the methods described in *HFS 157.13(15)* to verify that the recipient is properly authorized to receive it. In addition, all packages containing radioactive sources must be prepared and shipped in accordance with DHFS/DOT requirements. Records of the transfer must be maintained as required by *HFS 157.13(18)*.

### Response from Applicant :

#### Item 11 Waste Management (Check box)

- ☐ We will return the radiography sealed source(s) to the manufacturer for disposal or transfer the radiography sealed source(s) to a specific licensee, authorized by DHFS, the NRC or an Agreement State to receive radioactive material.

**Note:** Because of the difficulties and costs associated with disposal of sealed sources containing radioactive material and devices containing depleted uranium, applicants should preplan the disposal. Applicants may want to consider contractual arrangements with the sealed source and device supplier as part of a purchase agreement.

## Item 12 License Fees

**Rule:** *HFS 157.10*

**Criteria:** On DPH Form 45013 ‘*Application for a Radioactive Material License Authorizing the use of Industrial Radiography*’ (**Appendix A**), enter the fee category and the amount of the fee enclosed with the application.

**Response from Applicant :**

SPECIFIC LICENSE FEE	
Item 12 License Fees (Refer to Wisconsin Administrative Code HFS 157.10)	
Category:	License Fee Enclosed: <input type="checkbox"/> Yes <input type="checkbox"/> No   Amount Enclosed _____

## Item 13: Certification

**Criteria:**

- Individuals acting in a private capacity are required to sign and date DPH form No. 45013, ‘*Application for a Radioactive Material License Authorizing the use of Industrial Radiography*’ (**Appendix A**).
- Senior representatives of a corporation or legal entity must sign and date DPH form No. 45013, ‘*Application for a Radioactive Material License Authorizing the use of Industrial Radiography*’ (**Appendix A**).

Representatives signing an application must be authorized to make binding commitments and sign official documents on behalf of the applicant. As discussed in the section titled ‘Management Responsibility’, signing the application acknowledges management's commitment and responsibilities for the radiation protection program. DHFS will return all unsigned applications for proper signature.

**Response from Applicant:**

**CERTIFICATION** (To be signed by an individual authorized to make binding commitments on behalf of the applicant.)

**Item 13**

I hereby certify that this application was prepared in conformance with Chapter HFS 157 "Radiation Protection" and that all information contained herein, including any supplements attached hereto, is true and correct to the best of my knowledge and belief.

**SIGNATURE** - Applicant Or Authorized Individual

Date signed

Print Name and Title of above signatory

**Note:** It is a violation of **Chapter HFS 157 'Radiation Protection'** to make a willful false statement or representation on applications or correspondence.

When the application references commitments, those items become part of the licensing conditions and regulatory requirements.

## **Appendix A:**

### **DPH Form 45013**

***‘Application for a Radioactive Material License  
Authorizing the use of Industrial Radioagraphy’***

**To access this form please go to:**

**<http://dhfs.wisconsin.gov/forms/DPH/dph45013.pdf>**

**Appendix B:**

**DPH Form 45007**

***‘Certificate of Disposition of Material’***

**To access this form please go to:**  
**<http://dhfs.wisconsin.gov/forms/DPH/dph45007.pdf>**



# **Appendix C:**

## **Reserved**

# **Appendix D:**

## **Reserved**

**Appendix E:**

**Information Needed for Change of Ownership or  
Control Application**

## Information Needed for Transfer of Control Application

Licensees must provide full information and obtain DHFS's prior written consent before transferring control of the license; some licensees refer to this as "transferring the license." Provide the following information concerning changes of control by the applicant (transferor and/or transferee, as appropriate). If any items are not applicable, so state.

1. The new name of the licensed organization. If there is no change, the licensee should so state.
2. The new licensee contact and telephone number(s) to facilitate communications.
3. Any changes in personnel having control over licensed activities (e.g., officers of a corporation) and any changes in personnel named in the license such as the RSO, AUs, or any other persons identified in previous license applications as responsible for radiation safety or use of licensed material. The licensee should include information concerning the qualifications, training, and responsibilities of new individuals.
4. An indication of whether the transferor will remain in non-licensed business without the license.
5. A complete, clear description of the transaction, including any transfer of stocks or assets, mergers, etc., so that legal counsel is able, when necessary, to differentiate between name changes and transfer of control.
6. A complete description of any planned changes in organization, location, facility, equipment, or procedures (i.e., changes in operating or emergency procedures).
7. A detailed description of any changes in the use, possession, location, or storage of the licensed materials.
8. Any changes in organization, location, facilities, equipment, procedures, or personnel that would require a license amendment even without the transfer of control.
9. An indication of whether all surveillance items and records (e.g., calibrations, leak tests, surveys, inventories, and accountability requirements) will be current at the time of transfer. Provide a description of the status of all surveillance requirements and records.
10. Confirmation that all records concerning the safe and effective decommissioning of the facility, pursuant to **HFS 157.15**, public dose; and waste disposal by release to sewers, incineration, radioactive material spills, and on-site burials, have been transferred to the new licensee, if licensed activities will continue at the same location, or to DHFS for license terminations.
11. A description of the status of the facility. Specifically, the presence or absence of contamination should be documented. If contamination is present, will decontamination occur before transfer? If not, does the successor company agree to assume full liability for the decontamination of the facility or site?
12. A description of any decontamination plans, including financial assurance arrangements of the transferee, as specified in **HFS 157.15**. Include information about how the transferee and transferor propose to divide the transferor's assets, and responsibility for any cleanup needed at the time of transfer.

13. Confirmation that the transferee agrees to abide by all commitments and representations previously made to DHFS by the transferor. These include, but are not limited to: maintaining decommissioning records required by *HFS 157.15*; implementing decontamination activities and decommissioning of the site; and completing corrective actions for open inspection items and enforcement actions.

With regard to contamination of facilities and equipment, the transferee should confirm, in writing, that it accepts full liability for the site, and should provide evidence of adequate resources to fund decommissioning; or the transferor should provide a commitment to decontaminate the facility before transferring control.

With regard to open inspection items, etc., the transferee should confirm, in writing, that it accepts full responsibility for open inspection items and/or any resulting enforcement actions; or the transferee proposes alternative measures for meeting the requirements; or the transferor provides a commitment to close out all such actions with DHFS before license transfer.

14. Documentation that the transferor and transferee agree to transferring control of the licensed material and activity; documentation of the conditions of transfer; and documentation that the transferee is made aware of all open inspection items and its responsibility for possible resulting enforcement actions.
15. A commitment by the transferee to abide by all constraints, conditions, requirements, representations, and commitments identified in the existing license. Lacking this, the transferee must provide a description of its program, to ensure compliance with the license and DHFS rule.

## **Appendix F:**

### **NRC Information Notice (IN) 96-20**

***‘Demonstration of Associated Equipment Compliance  
with 10 CFR 34.20’***

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS  
WASHINGTON, D.C. 20555

April 4, 1996

NRC INFORMATION NOTICE 96-20: DEMONSTRATION OF ASSOCIATED EQUIPMENT  
COMPLIANCE WITH 10 CFR 34.20

Addressees: All industrial radiography licensees and radiography equipment manufacturers.

Purpose: The U.S. Nuclear Regulatory Commission is issuing this information notice to inform radiography licensees of acceptable methods to demonstrate that their associated equipment used in radiographic operations meets the regulations in 10 CFR 34.20. It is expected that recipients will review the information for applicability to their facilities and consider appropriate actions. However, this information notice does not contain any new requirements; therefore, no specific action nor written response is required.

Description of Circumstances: Section 34.20 of 10 CFR Part 34 specifies performance requirements for radiography equipment. Paragraph (d) of 10 CFR 34.20 provided that all newly manufactured radiographic exposure devices and associated equipment (manufactured after January 10, 1992) acquired by NRC licensees must meet Section 34.20 requirements. Paragraph (e) of 10 CFR 34.20 provides that all radiographic exposure devices and associated equipment in use by NRC licensees after January 10, 1996, must comply with the requirements specified in 10 CFR 34.20. NRC amended the regulations in 10 CFR 34.20 to permit licensees to use an alternate value of torque for performance testing criteria and to allow licensees to use engineering analysis to demonstrate that a modest change in an already approved design is acceptable without the need to perform prototype testing. The changes were published in the Federal Register as a final rule on May 31, 1995. NRC Information Notice (IN) 95-58: "10 CFR 34.20; Final Effective Date," issued on December 18, 1995, to all radiography licensees, reminded licensees of the final effective date implementing the regulations in 10 CFR 34.20. IN 95-58 also reminded licensees that associated equipment used with radiography cameras (i.e., source assemblies, drive cables, guide tubes, control tubes, source stops, etc.) were subject to 10 CFR 34.20 requirements. IN 95-58 went on to explain that, previously, certain associated equipment had not been independently registered and/or evaluated by the NRC or the Agreement States (AS). This includes drive cables, guide tubes, and source stops. Most new camera models and their basic associated equipment were registered as part of the gamma radiography system as described in

the American National Standard N432-1980, "Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography." Therefore, information concerning certain associated equipment to be used with the devices was included as part of the overall system evaluation and registration process. Some manufacturers have also been labeling their equipment with an identifier, such as the manufacturer's logo, to indicate that the equipment meets the requirements of 10 CFR 34.20. IN 95-58 went on to remind licensees that 10 CFR 34.20 makes the licensee responsible for ensuring that equipment meets regulatory requirements. NRC and AS review and evaluate radiography-associated equipment (guide tubes, exposure heads, and collimators) as well as sealed sources, radiographic exposure devices (cameras) and source changers for compliance with 10 CFR Part 34. On completion of this evaluation, acceptable components are identified on a registration certificate. Information is also included in a National Registry System maintained by NRC. Regulatory authorities use this information in their licensing and inspection activities.

Discussion: The regulation on performance requirements for radiography equipment--Section 34.20--requires that the radiographic exposure device and all associated equipment must meet the requirements of ANSI N432-1980, and other specific requirements listed in 10 CFR 34.20. Associated equipment includes source assemblies, drive cables, guide tubes, control tubes, cranks, "J" tubes, collimators, exposure heads, and source stops. In particular for guide tubes, 10 CFR 34.20(c)(5) states, "The guide tube must have passed the crushing tests for the control tube as specified in ANSI N432 and a kinking resistance test that closely approximates the kinking forces likely to be encountered during use." In addition, 10 CFR 34.20(c)(8) requires that the connection between the guide tube and exposure head be able to withstand the tensile test for control units specified in ANSI N432. Since Section 8.9 of ANSI N432-1980 specifies that radiography systems must withstand the endurance test described in that section, licensees must demonstrate that guide tubes and exposure heads will withstand the endurance test. Recently some questions were raised concerning what constitutes an exposure head vs. a guide tube. Exposure heads may be a separate or integral part of a guide tube. NRC's analysis of associated equipment (i.e., collimators, guide tubes, exposure heads) has shown that there is little risk of obstruction of source travel for equipment that guides a source assembly a distance less than 10 times the length of the source capsule. NRC's analysis included a review of equipment designs and incidents involving source travel obstructions. Based on these findings, NRC's policy is that associated equipment that guides a source assembly a distance greater than 10 times the length of the source capsule (i.e., exposure heads, "J" tubes, jet engine probes, source stops) is considered a guide tube and must meet the testing requirements for guide tubes. In addition, NRC's policy is that only associated equipment that comes in contact with the source (e.g., collimators that slip over the end stop) must meet the applicable testing requirements. The NRC has identified several ways licensees can demonstrate that their radiography equipment meets 10 CFR 34.20 requirements. First, the most direct method would be that the equipment that has been labeled by the manufacturer pursuant to a registration certificate. (If the label has worn off, you should contact the



manufacturer or have support information as described below.) Alternatively, licensees can make this demonstration if they can provide a document trail to registered associated equipment. The equipment will be considered to meet the requirements, if the licensee has in its possession one of the following for each piece of equipment:

- A purchase order(s) listing the radiography equipment that can be tied-back to a registration certificate; or,
- Documentation from the manufacturer verifying that the equipment the licensee is using was approved and registered with the NRC or AS. The documentation must clearly identify which equipment meets the requirements; or,
- A signed NRC or AS recognized checklist(s) certifying that the licensee has evaluated its equipment, and that it meets the specifications of the checklist. In order for the checklist to be recognized, it must have been provided by the manufacturer of the equipment and approved by the NRC or AS. As of this date, only one checklist has been approved. See Attachment 1 for the recognized checklist.

If a licensee possesses and intends to use radiography equipment that is not labeled by the manufacturer, or that the licensee cannot demonstrate that it meets 10 CFR 34.20 requirements, then the licensee must submit an application for a custom evaluation. Attachment 2 includes information on how to file an application for custom evaluation. Equipment cannot be used in radiographic operations until it has been approved for use by NRC or an AS. This information notice requires no specific action nor written response. If you have any questions about the information in this notice, please contact the technical contact listed below or the appropriate regional office.

Signed by

---

Donald A. Cool, Director

Division of Industrial and Medical Nuclear Safety

Office of Nuclear Material Safety and Safeguards

Attachments:

1. Recognized Checklist for Associated Equipment
2. Custom Evaluation of Associated Equipment
3. List of Recently Issued NMSS Information Notices
4. List of Recently Issued NRC Information Notices

Contact: Thomas W. Rich, NMSS

(301) 415-7893

## Attachment 1: Recognized Checklist for Associated Equipment

### Checklist for Amersham's Model 591 Controls

To assure the associated equipment you are using are approved Amersham-manufactured accessories, please perform a side-by-side comparison against a known (i.e., flying A is legible or POs are available) Amersham-manufactured piece. Perform a detailed mechanical and visual inspection of your equipment against the following checklist. If you have any questions, please call Amersham for assistance.

Amersham Controls:

1. All controls have a yellow polyvinyl housing with a 9/16-inch outer diameter.
2. The fittings are 3 inches long (including the hex nut).
3. The hex nut is 11/16 inch.
4. Check the fittings for swage marks, the fittings will have 3 single swage marks 1/8 inch wide and 1/2 inch apart or 4 single swage marks 1/8 inch wide and 1/2 inch apart.
5. The first swage mark is typically 3/8 inch from the end.
6. The thread pattern for the control connector is 5/8"-18.
7. The 661 connector assembly will have an indentation 1/2 inch wide band behind the jaws; for newer units this will be covered with a red stripe, but this stripe may have worn off on the older models.

To the best of my knowledge the piece of equipment identified below (the equipment must be uniquely identifiable, either by labeling, marking, or tagging, or other means to signify which piece of equipment is certified as meeting the conditions of this checklist) has been manufactured after 1964, meets the conditions of this checklist, and is the same design as a similar piece of equipment that has been registered and approved by the NRC.

Specify Equipment (i.e., Guide Tube)

Include Identifier/Labeling

Signature

Printed or Typed Name

## Amersham Model 402, 489, and 676 Guide Tubes

To assure the associated equipment you are using are approved Amersham-manufactured accessories, please perform a side by side comparison against a known (i.e., flying A is legible or POs are available) Amersham-manufactured piece. Perform a detailed mechanical and visual inspection of your equipment against the following checklist. If you have any questions, please call Amersham for assistance.

### Amersham Guide Tubes:

1. Housing should be yellow polyvinyl with either a 5/8 inch or 3/4 inch outer diameter.
2. The fittings are yellow irradiated steel, the threaded fittings consist of 1 inch 18 thread.
3. The fittings for both the threaded fitting and the source stop fitting will have 2 single swage marks approximately 1/4 inch apart.
4. The Amersham standard source stops are made from aluminum and are 2 1/2 inches long.

To the best of my knowledge the piece of equipment identified below (the equipment must be uniquely identifiable, either by labeling, marking, or tagging, or other means to signify which piece of equipment is certified as meeting the conditions of this checklist) has been manufactured after 1964, meets the conditions of this checklist, and is the same design as a similar piece of equipment that has been registered and approved by the NRC.

Specify Equipment (i.e., Guide Tube)

Include Identifier/Labeling

Signature

Printed or Typed Name

## **Attachment 2: Custom Evaluation of Associated Equipment**

### **Custom Evaluation of Associated Equipment**

The information provided below applies to custom registration of associated equipment.

#### **Product Registration**

Either the manufacturer, distributor, or user of the radiographic equipment can submit the information outlined in 10 CFR 32.210 for evaluation.

If the applicant is located within the jurisdiction of the U.S. Nuclear Regulatory Commission, the application should be sent to the following address:

U.S. Nuclear Regulatory Commission  
Sealed Source Safety Section  
Mail Stop T-8-F-5  
Washington, DC 20555

Otherwise, the applicant should submit the information to the appropriate Agreement State.

#### **Application Contents**

##### **1. General:**

Licensees are required to use only radiography equipment, including exposure heads and source guide tubes, that meets the requirements specified in 10 CFR 34.20. The regulations require that the exposure device and all associated equipment must meet the requirements in American National Standard N432-1980, "Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography," and other specific requirements listed in 10 CFR 34.20. The standard defines the requirements for the design and method of qualifying (testing) prototypes of gamma radiography systems. Refer to Regulatory Guide 10.10, "Guide for the Preparation of Applications for Radiation Safety Evaluation and Registration of Devices Containing Byproduct Material" for information on what types of information needs to be included in your application.

##### **2. Specific:**

Applications for registration for the equipment must, at a minimum, include the following documentation:

- A demonstration, either by testing or by engineering analysis, that prototypes of the associated equipment meets the appropriate tests listed below;
- A list of all radiographic exposure equipment with which the associated equipment will be used, and an explanation of how the associated equipment is compatible with each piece of radiographic exposure equipment;
- Details of how the associated equipment will be identified, such as by labeling, marking, or tagging, as meeting the requirements of Section 34.20;
- Complete specifications, including materials, details of construction, and complete dimensions of each component of the equipment; and
- Likely environments (i.e., temperature, pressure, vibration, humidity, impact) and conditions of use of the equipment.

### 3. Prototype Tests

Each associated equipment design (e.g., source guide tube, collimator, exposure head) must either pass the appropriate tests listed below, or demonstrate by engineering analysis that the designs would likely meet the test requirements.

NRC's policy is that associated equipment that guides a source assembly a distance greater than 10 times the length of the source capsule (i.e., exposure heads, "J" tubes, jet engine probes, source stops) is considered a guide tube and must meet the testing requirements for guide tubes.

### 4. Source Guide Tube Tests

Source guide tubes are required to meet the following:

- The crushing test specified in Section 8.6 of ANSI N432-1980;
- A kinking resistance test that closely approximates the kinking forces likely to be encountered during use;
- The endurance test specified in Section 8.9 of ANSI N432-1980; and
- The tensile tests specified in Section 8.7 of ANSI 432-1980 for control units.

### 5. Exposure Head and Collimator Tests

Exposure heads and collimators that are not considered guide tubes, need only meet the tests listed in item c, and d above.

### 6. Engineering Analysis

Engineering analysis will be considered in lieu of actual testing if the analysis is based on a similar design that

has been tested in accordance with the standard and has been approved by the NRC or Agreement State. The engineering analysis, at a minimum, must compare the tested design against the associated equipment you want evaluated and address the effects of the materials of construction (i.e., wear resistance, strength, corrosion properties); the wall thickness; the length (i.e., resistance); any bends, bend angles and the minimum bend radii over which the bends will be produced (curvature); and any other properties that would have an effect on the outcome of the endurance test.

**Appendix G:**

**Radiographer and Radiographer's Assistant  
Training**

## Radiographer's Training

REFERENCE	REQUIREMENT	TRAINING CRITERIA
<i>157.44(3)(a)</i>	<p>Training</p> <p>Classroom Training – 40 hours in Length</p>	<p>Topics in <i>157.44(3)(g)</i></p> <p>Fundamentals of Radiation Safety</p> <ul style="list-style-type: none"> <li>• Characteristics of gamma radiation</li> <li>• Units of radiation dose and quantity of radioactivity</li> <li>• Hazards of exposure to radiation</li> <li>• Levels of radiation from licensed material</li> <li>• Methods of controlling radiation dose (time, distance, and shielding)</li> </ul> <p>Radiation Detection Instruments</p> <ul style="list-style-type: none"> <li>• Use, operation, calibration and limitations</li> <li>• Survey techniques</li> <li>• Personnel monitoring equipment</li> </ul> <p>Equipment to be Used</p> <ul style="list-style-type: none"> <li>• Operation and control of radiographic exposure equipment, remote handling equipment, storage containers and pictures or models of source assemblies (pigtailed)</li> <li>• Storage, control and disposal of licensed material</li> <li>• Inspection and maintenance of equipment</li> </ul> <p>Requirements of <b>Chapter HFS 157 ‘Radiation Protection’</b>.</p> <p>Case Histories of Accidents in Radiography</p>
	On-the-Job Training-- 2 months or 320 hours	Under the supervision of a qualified radiographer
	Certification by a Certifying Entity	Certified through a radiographer certification program meeting the requirements of <i>10 CFR 34 Appendix A</i>
<i>157.44(3)(b)</i>	Must Receive Copies of and Instruction in:	<p><b>HFS 157</b> Subchapters:</p> <ul style="list-style-type: none"> <li>• III</li> <li>• IV</li> <li>• X</li> <li>• XIII</li> </ul> <p>The License</p> <p>The Licensee's Operating &amp; Emergency Procedures</p>



	Written or Oral Examination of items listed above	Successful completion
	Receive Equipment Training	Training includes: <ul style="list-style-type: none"> <li>• Exposure devices</li> <li>• Sealed sources</li> <li>• Associated equipment</li> <li>• Survey meters</li> <li>• Daily inspection</li> </ul>
	Demonstrate Understanding in Use of Equipment by Practical Exam	Successful completion
<i>157.44(3)(d)</i>	Annual Refresher Training	Review the following: <ul style="list-style-type: none"> <li>• Radiation Safety review</li> <li>• New procedures or equipment</li> <li>• New rule requirements</li> <li>• Observations and deficiencies during audits and discussion of any significant incidents or accidents involving radiography</li> <li>• Employee questions</li> </ul>
<i>157.45(9)</i>	Records	Maintained in accordance with rule

## Radiographer's Assistant Training

REFERENCE	REQUIREMENT	TRAINING CRITERIA
<i>157.44(3)(c)</i>	Must Receive Copies of and Instruction in:	<b>HFS 157 Subchapters:</b> <ul style="list-style-type: none"> <li>• III</li> <li>• IV</li> <li>• X</li> <li>• XIII</li> </ul> <p>The License The Licensee's Operating &amp; Emergency Procedures</p>
	Written or Oral Examination of items listed above	Successful completion
	Receive Equipment Training	<p>Training under the supervision of a qualified radiographer that includes:</p> <ul style="list-style-type: none"> <li>• Exposure devices</li> <li>• Sealed sources</li> <li>• Associated equipment</li> <li>• Survey meters</li> <li>• Daily inspection</li> </ul>
	Demonstrate Understanding in Use of Equipment by Practical Exam	Successful completion
<i>157.44(3)(d)</i>	Annual Refresher Training	<p>Review the following:</p> <ul style="list-style-type: none"> <li>• Radiation Safety review</li> <li>• New procedures or equipment</li> <li>• New rule requirements</li> <li>• Observations and deficiencies during audits and discussion of any significant incidents or accidents involving radiography</li> <li>• Employee questions</li> </ul>
<i>157.45(9)</i>	Records	Maintained in accordance with rule

## **Appendix H:**

### **Six-Month Radiographer/Radiographer's Assistant Inspection Checklist**

## Six-Month Radiographer/Radiographer's Assistant Inspection Checklist

Date: _____ Time: _____	
Radiographic Location: _____	
Radiographer/Radiographer Assistant: _____	
Device Model No.: _____	Serial No.: _____
Survey Meter Functionality: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Calibrated: <input type="checkbox"/> Yes <input type="checkbox"/> No	Daily Source Check: <input type="checkbox"/> Yes <input type="checkbox"/> No
Dosimetry: TLD, Film Badge, Or Similar Device and Pocket Dosimeter: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Pocket Dosimeter Calibrated: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Alarming Dosimeter: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Calibrated: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Daily Operational Check Performed: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Were other individuals working within the restricted area wearing film badges, TLDs or similar devices, dosimeters and alarm dosimeters?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the restricted area posted with a "CAUTION (or DANGER) RADIATION AREA" sign(s)?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the restricted area properly controlled to prevent unauthorized entry?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the high-radiation area posted with a "CAUTION (OR DANGER) HIGH RADIATION AREA" sign(s)?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the utilization log properly filled out?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Did the radiographer/radiographer's assistant have sufficient knowledge of safety rules?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the radiographer working with properly inspected and operable equipment?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Did the radiographer/radiographer's assistant properly survey the camera?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Did the radiographer properly supervise the radiographer's assistant?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the camera properly locked and secured to prevent unauthorized removal?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the restricted area properly controlled?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the high radiation area under continuous direct observation except where entry had been prevented?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Were radioactive isotopes stored properly and kept locked to prevent removal?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the storage area posted with a "CAUTION (or DANGER) RADIOACTIVE MATERIAL" sign(s)?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Did the radiographer/radiographer's assistant possess and use a copy of the operating and emergency procedures and <b>DHFS</b> rules for protection against radiation?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Were there any other safety items found to be lacking? If yes, explain in Remarks.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Remarks/Comments: _____ _____ _____ _____ _____	

**Appendix I:**

**Radiation Protection Program Audit**

## Radiation Protection Program Audit

Date of this Audit: \_\_\_\_\_

Date of Last Audit: \_\_\_\_\_

Next Audit Date: \_\_\_\_\_

Auditor \_\_\_\_\_

Date \_\_\_\_\_

(Signature)

Management Review \_\_\_\_\_

Date \_\_\_\_\_

(Signature)

## Organization and Scope of Program

A. Organizational structure. (specify any changes)

1. Matches license requirements. [*L/C*]
2. Multiple authorized locations of use and/or field sites authorized.
3. List of location(s) inspected - attached or reference.
4. Brief description of scope of activities, including types of equipment, types and quantities of use involving radioactive material, frequency of use, staff size, etc.

B. Radiation Safety Officer.

1. Named on license. [*L/C*]
2. Fulfills duties as RSO. [*HFS 157.44(2)(d)*]
3. Meets requirements. [*HFS 157.44(2)(b)*]

C. Radiographers and radiographer's assistants named in documents. [*L/C*]

## Training, Retraining, and Instructions to Workers

A. Instructions to workers. [*HFS 157.88(2)*]

B. Sections: III, IV, X, and XIII; the license; and Operating and Emergency Procedures are furnished to all radiographers and radiographer's assistants. [*HFS 157.44(3)(b) & (c)*]

C. Training program description the same as that submitted with license application or as amended?

[*HFS 157.13(6)*, *HFS 157.44(3)*]

1. Written tests completed by all radiographers and radiographer's assistants.
2. Oral tests.
3. All radiographers completed on-the-job training.
4. Periodic training program implemented.
5. Records maintained [*HFS 157.45(9)*].

D. Workers cognizant of requirements for:

1. Radiation safety program. [*HFS 157.21*]
  - a. Occupational exposure annual limits. [*HFS 157.22(1)&(2)*]
  - b. Public annual dose limits. [*HFS 157.23(1)&(2)*]
2. 10% monitoring threshold. [*HFS 157.25(2)*]
3. Dose limits to embryo/fetus and declared pregnant worker. [*HFS 157.22(8)*]
4. Procedures for opening packages. [*HFS 157.29(6)*]

### **Operating and Emergency Procedures**

A. Procedures current? [*HFS 157.44(4)(b)*]

B. Procedures contain information specified. [*HFS 157.44(4)(a)*]

C. Procedures submitted to DHFS. [*L/C*]

### **Internal Audits or Inspections**

A. Audits/inspections of each radiographer and radiographer's assistants conducted at 6-month intervals or after as appropriate. [*HFS 157.44(3)(e)*]

B. Equipment check before use each day. [*HFS 157.41(1)*]

C. Equipment inspection and maintenance performed at 3-month intervals. [*HFS 157.41(2)*]

D. Records maintained. [*HFS 157.41(2)(c)*]

## **Facilities**

### **A. Permanent radiographic installation. [*HFS 157.42*]**

1. High Radiation Area posted. [*HFS 157.29(2)*]
2. Entrance controls are as described. [*HFS 157.26*]
  - a. Visible and audible radiation signals.
  - b. Visible signal actuates if entry is attempted when source is exposed.
  - c. Audible signal actuates if entry is attempted when source is exposed.
  - d. System tested daily with radiation source.
  - e. Records maintained for 3 years. [*HFS 157.42(2)*]

### **B. Temporary High Radiation Area Entry Controlled. [*HFS 157.26*]**

### **C. Storage Area**

1. Storage Facilities as Described in license. [*L/C*]
2. Sources Locked in Devices. [*HFS 157.37(2)*]
3. Devices secured to prevent tampering or unauthorized removal. [*HFS 157.37(2)*]

## **Equipment**

### **A. Radiography devices, source assemblies and source changers in use meet requirements. [*HFS 157.36*]**

### **B. Associated equipment in use complies with requirements. [*HFS 157.36*]**

### **C. Source changers and storage containers meet radiation level limits. [*HFS 157.37*]**

### **D. Equipment exempted by specific license condition is used in accordance with license commitments and authorization.**

## **Materials**

### **A. Isotope, chemical/physical form, quantity and use as authorized on the license. [*L/C*]**

### **B. All sealed sources not fastened to or contained in an exposure device are tagged. [*HFS 157.36(b)(4)*]**



C. Leakage and contamination tests.

1. Sealed sources.
  - a. Leak test method approved. [*HFS 157.39(1)*]
  - b. Leak tests performed at 6 month intervals. [*HFS 157.39(2)*]
  - c. Leakage is less than 185 becquerels (Bq) (0.005 microcuries).
2. Depleted uranium (DU) shielding with S-tubes.
  - a. Test every 12 months. [*HFS 157.3992)(e)*]
  - b. DU is less than 185 Bq (0.005 microcuries).
3. Records maintained for 3 years. [*HFS 157.36(2)(b)&(e) 2*]

D. Inventories

1. Conducted quarterly (not to exceed 3 months). [*HFS 157.40(1)*]
2. Contain all required information. [*HFS 157.40(2)*]
3. Most recent inventory conducted on \_\_\_\_\_

E. Utilization Logs

1. Utilization logs maintained. [*HFS 157.45(6)*]
2. Contain all required information. [*HFS 157.45(6)*]

**Instrumentation**

A. Describe the survey instruments possessed:

Model No. \_\_\_\_\_ Quantity \_\_\_\_\_

B. Capable of measuring 0.02 mSv (2 mrem)/hr through 0.01 Sv (1 rem)/hr. [*HFS 157.38(1)*]

C. Operable and calibrated survey instruments available and used on each job. [*HFS 157.38(1)*]

D. Calibration performed at intervals not to exceed six months or after servicing. [*HFS 157.38(2)*]

E. Records maintained for 3 years. [*HFS 157.45(3)*]

**Radiation Surveys**

A. Area or facility surveys conducted to show compliance with *HFS 157.23(1)&(2)*. [*HFS 157.44(9)*]

B. Records maintained. [*HFS 157.45(12)*]

C. Survey after each exposure, including device, guide tube, ensuring source has returned to the shielded position. [*HFS 157.44(7)*]

D. Survey of device when place in storage to ensure source is in shielded position. [*HFS 157.44(7)*]

E. Protection of members of the public [*HFS 157.23(1)*]

1. Adequate surveys made to demonstrate.

a. The TEDE to the individual likely to receive the highest dose does not exceed 0.1 mSv (100 mrem) in a year;

**Or**

b. That if an individual were continuously present in an unrestricted area, the external dose would not exceed 1 mSv (100 mrem) in a year. [*HFS 157.23(2)*]

2. Unrestricted area radiation levels do not exceed 0.02 mSv (2 mrem) in any 1 hour. [*HFS 157.23(1)*]

3. Records maintained. [*HFS 157.23(1); 157.32(8)*]

## **Personnel Radiation Protection**

A. Dosimetry

1. Workers monitored as required. [*HFS 157.44(6)*]

2. Exchange Frequency \_\_\_\_\_ Supplier \_\_\_\_\_

3. Verify supplier is NVLAP-approved. [*HFS 157.25(1)(c)*]

4. Dosimetry exchanged at required frequency. [*HFS 157.44(6)*]

5. Dosimetry records maintained. [*HFS 157.45(11)*]

B. Pocket Dosimeters and Electronic Personal Dosimeters [*HFS 157.44(6)*]

1. Model No. \_\_\_\_\_ Range \_\_\_\_\_

Model No. \_\_\_\_\_ Range \_\_\_\_\_

2. Read and recorded at start of each shift.

3. Daily readings recorded.

4. Dosimeters checked for response ( $\pm 20\%$ ) at intervals not to exceed 12 months.

5. Off-scale dosimeter procedure and records.

C. Alarm Ratemeters [*HFS 157.44(6)(g)*]

1. Model No. \_\_\_\_\_ Range \_\_\_\_\_

2. Checked that alarm functions properly at start of each shift.
3. Preset at 5 mSv (500 mrem)/hr.
4. Calibrated to  $\pm 20\%$  at intervals not to exceed 12 months.
5. Records maintained.

#### D. Dosimetry Reports

1. Reviewed by \_\_\_\_\_ Frequency \_\_\_\_\_.
2. Reviewed personnel monitoring records for interval (from \_\_\_\_\_ to \_\_\_\_\_).
3. Maximum exposures: TEDE \_\_\_\_\_ extremity, other \_\_\_\_\_.
4. DPH Forms (or equivalent). [*HFS 157.31(7)*]
5. Maximum exposures in compliance with annual limits. [*HFS 157.22(1)*]
6. Fetal and Pregnant worker exposure. [*HFS 157.22(8), 157.25(2)*]
  - a. Worker declared pregnancy in writing during the audit interval.
  - b. If yes, licensee in compliance? Records maintained?
7. Dosimetry records maintained. [*HFS 157.31(7)*]

#### E. Radiation Protection Program [*HFS 157.21*]

1. Program includes provisions for keeping dose ALARA.
2. Procedures and engineering controls used to achieve ALARA.
3. Content and implementation reviewed annually by licensee.
4. Records of program reviews maintained.

#### F. Planned Special Exposures (PSEs) [*HFS 157.22(6)*]

1. PSEs performed? \_\_\_\_\_
2. If so, when, where and why? \_\_\_\_\_
3. Records maintained.

#### Receipt and Transfer of Radioactive Material [*HFS 157.29(6)*]

- A. Procedures established and followed for picking up, receiving and opening packages.
- B. Incoming packages surveyed.
- C. Shipment of sources since last inspection.
  1. Used container authorized by license or Certificate of Compliance (COC).

2. Transfers.
3. All sources surveyed before shipment and transfer.

D. Records of surveys and receipt/transfer maintained. [***HFS 157.31(3)***]

**Transportation (157.92 and 49 CFR 170-189)**

A. Shipments are:

- ☐ Delivered to common carriers.
- ☐ Transported in company's private vehicle.
- ☐ Both.
- ☐ No shipments since last audit.

B. HAZMAT training [***49 CFR 172.700- 172.704***]

C. Packages:

1. Authorized packages used. [***49 CFR 173.415; 173.416***]
2. Performance test records on file.
  - a. Special form sources. [***49 CFR 173.476(a)***]
  - b. DOT-7A packages. [***49 CFR 173.415(a)***]
3. COC's on file with NRC for Type B. [***10 CFR 71.12(c)(1)***]
4. Two labels with Transport Index, Nuclide, Hazard Class. [***49 CFR 172.403; 172.441***]
5. Properly marked (Shipping name, UN number, Package type, RQ, Name and address of consignee. [***49 CFR 172.301; 172.310; 172.324; 172.101***]
6. Closed and sealed during transport. [***49 CFR 173.475(f)***]

D. Shipping papers

1. Prepared and used. [***49 CFR 172.200(a)***]
2. Proper (Shipping name, Hazard class, UN number, Quantity, Package type, Nuclide, RQ, Radioactive material, Physical and chemical form, Category of label, TI, Shipper's name, Certification and signature, Emergency response phone number, "Limited Quantity""Cargo Aircraft Only" if applicable). [***49 CFR 172.200 - 172.204; 175.700***]
3. Readily accessible during transport.

E. Vehicles

1. Placarded. [***49 CFR 172.504***]
2. Cargo blocked and braced. [***49 CFR 177.842(d)***]

3. Proper overpacks (shipping name, UN number label, statement of inner packaging complies with specification packaging). [*49 CFR 171.15; 171.16*]

F. Any transportation incidents reported to DOT National Response Center [*49 CFR 171.15; 171.16*]

### **Auditor's Independent Measurements**

A. Survey Instrument: \_\_\_\_\_

Serial No.: \_\_\_\_\_

Last Calibration: \_\_\_\_\_

B. Auditor's measurements were compared with audited person's measurement

C. Describe the type, location, and results of measurements, attach a diagram/survey sheet and refer to this section

### **Notifications and Reports**

A. Reports to individuals, public and occupational, monitored to show compliance [*HFS 157.88*]

B. Theft or loss [*HFS 157.32(1)*]

C. Incidents [*HFS 157.32(2)*]

D. Overexposures and high radiation levels [*HFS 157.32(3)*]

E. Annual reports furnished to DHFS [*HFS 157.32(5)*]

F. Reporting of defects and non-compliance [*HFS 157.13(17)(b)*]

### **Posting and Labeling**

A. Radiation areas [*HFS 157.29(2)*]

B. High radiation areas [*HFS 157.29(2)*]

C. Use or storage areas [*HFS 157.29(2)*]

D. Containers or devices labeled [*HFS 157.36*]

E. Notice to employee form [*HFS 157.88*]

**Recordkeeping for Decommissioning [*HFS 157.15(7)*]**

A. Records in independent and identifiable location

B. Records include all required data

**Bulletins and Information Notices**

A. Communications received and reviewed

B. Appropriate response to Information Notices

**Special License Conditions or Issues**

Evaluate special license conditions for data, actions

**Performance Evaluation Factors**

These indicators may provide an indication of the status of the Radiation Safety Program as perceived by management.

A. Lack of senior management involvement with the radiation safety program and/or RSO oversight

B. RSO too busy with assignments other than radiation safety

C. Insufficient staffing

D. Radiation Safety Committee fails to meet or functions inadequately

E. Inadequate consulting service or inadequate audits

# **Appendix J:**

## **Procedure for Calibrating Survey Instruments**

A. Sealed source(s) used for calibrating survey instruments should:

1. Approximate a point source
2. Have its exposure rate at a given distance traceable by documented measurements to a standard certified to be within +/- 5% accuracy by NIST
3. Approximate the same photon energy (Ir-192, Co-60) as the source to be used in the radiography device.
4. Be of sufficient strength to give an exposure rate of about 0.3 mSv/hr (30 mrem/hr) at 100 cm. (85 mCi of Cs-137 or 21 mCi of Co-60).

B. Use the inverse square and radioactive decay law to correct changes in exposure rate due to source decay or different distances from the source.

C. Record survey meter calibration data and maintain written records for each instrument being used to satisfy regulatory requirements. Survey meter calibration reports should indicate the procedure used and the data obtained. Calibration records should contain the following information and must be maintained 3 years from date of calibration of each instrument:

1. Owner or user identification, including name, address, and person to be contacted;
2. Instrument description that includes manufacturer, model number, serial number, and type of detector;
3. Calibration source description that includes exposure rate, indicated exposure rate at a specified distance on a specified date, and the calibration procedure;
4. Each calibration point identifying the calculated exposure rate, the indicated exposure rate, the deduced correction factor, and the scale selected on the instrument;
5. Exposure reading indicated with the instrument in the "battery check" mode, if available;
6. Angle between the radiation flux field and the detector (parallel, perpendicular);

**Note:** Internal detectors should specify angle between radiation flux field and a specified surface of the instrument

7. For detectors with removable shielding, note whether the shielding was in place or removed during the calibration procedure;
8. Include person's name who performed the calibration and the date on which the calibration was performed;

D. A single point on a survey meter scale can be considered satisfactorily calibrated if the indicated exposure rate differs from the calculated exposure rate by less than 10%.



**Note:** Three kinds of scales are frequently used on radiation survey meters:

1. Linear Scale: Meters on which the user selects a linear scale must be calibrated at no less than two points on each scale. The points should be at approximately  $1/3$  and  $2/3$  of the decade.
2. Multidecade Logarithmic Scale: Meters that have a multidecade logarithmic scale must be calibrated at no less than one point on each decade and no less than two points on one of the decades. Those points should be approximately  $1/3$  and  $2/3$  of the decade.
3. Automatically Ranging Digital Display: Meters that have a device for indicating rates must be calibrated at no less than one point on each decade and at no less than two points on one of the decades. Those points should be at approximately  $1/3$  and  $2/3$  of the decade.

E. Scales in excess of 10 mSv/hr (1,000 mrem/hr) need not be calibrated. However, such scales should be checked for operation and approximately correct response.

F. The following information should be attached to the instrument as a calibration sticker or tag:

1. Source that was used to calibrate the instrument
2. A calibration chart or graph for each scale or decade of a survey meter that is greater than  $\pm 20\%$  of the actual values identifying the average correction factor, or a note indicating that scale was checked only for function or is inoperative.
3. Date of calibration
4. Date survey instrument is due calibration
5. Name or initials of individual calibrating instrument.

**Note:** Detailed information about survey instrument calibration may be obtained by referring to ANSI N323-1978, "Radiation Protection Instrumentation Test and Calibration." Copies may be obtained from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

NUREG 1556, Volume 18 'Program-Specific Guidance About Service Provider Licenses' is available from the NRC website at [www.nrc.gov](http://www.nrc.gov).

## **Appendix K:**

# **Requests to Perform Leak Testing and Sample Analysis**

## **A. Requests to Perform Leak Testing and Sample Analysis**

1. Identify the individual who will make the analysis and provide his or her qualifications to make quantitative measurements of radioactivity.
2. Specify how and where test samples will be taken on the radiography device. Describe materials used and methods of handling samples to prevent or minimize exposure to personnel.
3. Specify the type of instrument(s) that will be used for measurement, the counting efficiency, and minimum levels of detection for each radionuclide to be measured.

**Note:** An instrument capable of making quantitative measurements should be used; hand-held survey meters will not normally be considered adequate for measurements.

4. Specify the standard sources used to calibrate the instrument; for each, specify the radionuclide, quantity, accuracy, and tractability to primary radiation standards.

**Note:** Accuracy of standards should be within  $\pm 5\%$  of the stated value and traceable to a primary radiation standard such as those maintained by the National Institutes of Standards and Technology (NIST).

NUREG 1556, Volume 18 'Program-Specific Guidance About Service Provider Licenses' is available at the NRC website: [www.nrc.gov](http://www.nrc.gov), or from DHFS upon request.

5. Include a sample calculation for conversion of the measurement data to Bq(or microcuries).
6. Provide instructions on actions to take and persons to be notified if sources are found to be leaking.

## **B. Procedure for Performing Leak Testing and Analysis**

1. For each source to be tested, list identifying information such as radiography device serial number, radionuclide, activity.
2. If available, use a survey meter to monitor exposure.
3. Prepare a separate wipe sample (e.g., cotton swab or filter paper) for each source.

4. Number each wipe to correlate with identifying information for each source.
5. Wipe the most accessible area where contamination would accumulate if the sealed source were leaking.
6. Using the instrument identified to, and approved by, DHFS, count and record background count rate.
7. Check the instrument's counting efficiency using standard source of the same radionuclide as the source being tested or one with similar energy characteristics.
8. Calculate efficiency.
9. Count each wipe sample; determine net count rate.
10. For each sample, calculate and record estimated activity in Bq (or microcuries).
11. Sign and date the list of sources, data and calculations.
12. If the wipe test activity is 185 Bq (0.005 microcurie) or greater, notify the RSO, so that the source can be withdrawn from use and disposed of properly. Also notify DHFS.

### **C. Sampling and Analysis for Depleted Uranium as a Result of S-tube Breakthrough**

**Note:** As an ALARA and safety measure, the source should be transferred to a source changer before the S-tube is tested for breakthrough.

1. The wipe test sample should be obtained from the areas of the tube where wear is likely to be most severe, at the first curve nearest the ends of the radiography device. The sample should be analyzed for alpha contamination. Alpha contamination present indicates that wear has broken through the S-tube to expose the depleted uranium.
2. Alpha counting sensitivity should be able to detect 185 Bq (0.005 microcuries) of contamination.
3. A worn S-tube could create equipment operating difficulties. Upon verification of the presence of alpha-particle emitting uranium, the radiographic exposure device should be removed from use until an evaluation of the wear of the S-tube has been made. Should the evaluation reveal that the S-tube is worn through, the device may not be used again. No user repairs are permitted.

## **Appendix L:**

### **Guidance for Demonstrating That Individual Members of the Public Will Not Receive Doses Exceeding the Allowable Limits**

## **A. Licensees must ensure that:**

1. The radiation dose received by individual members of the public resulting from the licensee's possession and/or use of licensed materials does not exceed 1 mSv (100 mrem) in one calendar year.

Members of the public include persons who live, work, or may be near locations where industrial radiography devices are used or stored and employees whose assigned duties do not include the use of licensed materials and who work in the vicinity where devices are used or stored.

2. The radiation dose in unrestricted areas does not exceed 0.02 mSv (2 mrem) in any one hour.
3. Typical unrestricted areas may include offices, shops, laboratories, areas outside buildings, property, and nonradioactive equipment storage areas. The licensee does not control access to these areas for purposes of controlling exposure to radiation or radioactive materials. However, the licensee may control access to these areas for other reasons such as security.
4. Licensees must show compliance with both portions of the rule. Radiographic operations at temporary jobsites must be demonstrated to have doses to the public in unrestricted areas that do not exceed 0.02 mSv (2 mrem) in any one hour. For storage areas and permanent radiographic facilities, calculations or a combination of calculations and measurements (e.g., using an environmental TLD) are often used to prove compliance with levels of 0.02 mSv (2 mrem) in any one hour and 1mSv (100 mrem) in a calendar year.

## **B. Calculational Method**

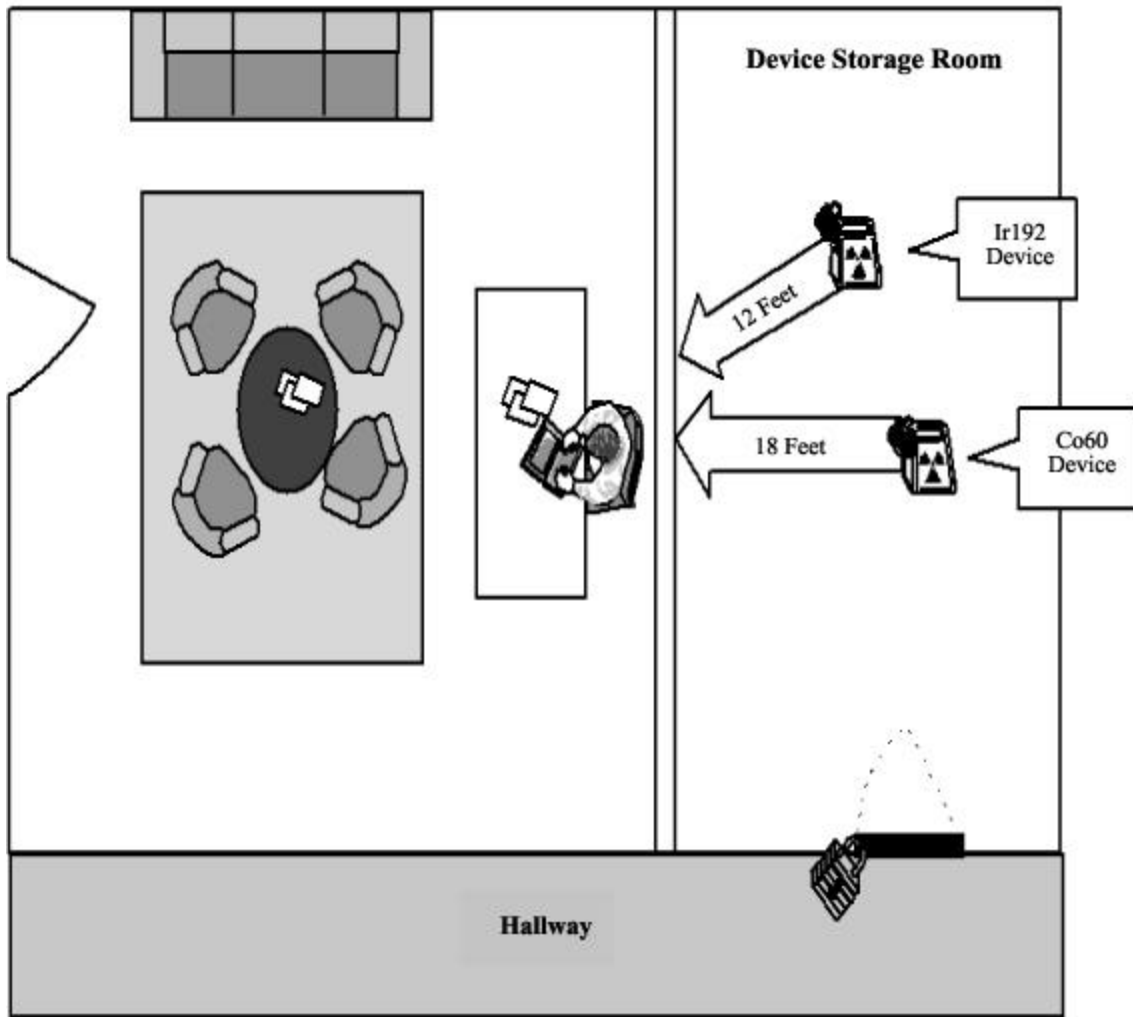
1. For ease of use by most industrial radiography licensees, the examples in this Appendix use conventional units. The conversions to SI units are as follows: 1 foot (ft) = 0.305 meter (m); 1 mrem = 0.01 mSv.
2. The calculational method takes a tiered approach, going through a three-part process starting with a worst case situation and moving toward more realistic situations. It makes the following simplifications: (1) each device is a point source, (2) typical radiation levels encountered when the source is in the shielded position are taken from either the Sealed Source & Device (SSD) Registration Sheet, the maximum dose levels allowed for a transport package (exposure device) labeled YELLOW III, or the manufacturer's literature, and (3) no credit is taken for any shielding found between the devices and the unrestricted areas.

3. Part 1 of the calculational method is simple but conservative. It assumes that a member of the public is present 24 hours a day, and it uses only the inverse square law to determine if the distance between the device and the affected member of the public is sufficient to show compliance with the public dose limits. Part 2 considers not only distance, but also the time that a member of the public is actually in the area under consideration. Part 3 considers distance and the portion of time that both the device and the affected member of the public are present. Part 4 considers the distance, the portion of time that both the device and the affected member of the public are present and the shielding provided by the structural materials or shielding materials specifically added by the licensee. Using this approach, licensees make only those calculations that are needed to demonstrate compliance. In many cases, licensees will need to use the calculational method through Part 1 or Part 2. These calculations typically result in higher radiation levels than would exist at typical facilities, but provide a method for estimating conservative doses which could be received.

### C. Example 1

1. To better understand the calculational method, Mo-Rad, Inc., a hypothetical radiography licensee, is demonstrated. Yesterday, the company's president noted that the new device storage area is close to his secretary's desk and he asked Joe, the Radiation Safety Officer (RSO), to determine if the company is complying with DHFS regulations.
2. The secretary's desk is near the wall separating the reception area from the designated, locked device storage area, where the company is storing its two devices. Joe measures the distances from each device to the wall and assumes that each device would have the maximum dose rate allowed under DHFS rule or DOT regulations: 2 mSv/hr (200 mrem/hr) on the surface and 0.1 mSv/hr (10 mrem/hr) at one meter. **Figure 13** is Joe's sketch of the areas in question, and **Table 8** summarizes the information Joe has on each device.

### A Bird's Eye View of Office and Device Storage Area



**D. Figure 13: Diagram of Office and Device Storage Area.** This sketch shows the areas described in examples 1 and 2.

**E. Table 8: Information Known about Each Device**

Description of Known Information	Device 1	Device 2
How device is stored	Ir-192 exposure device (Type B container)	Co-60 exposure device (Type B container)
Dose rate in mrem/hr encountered at specified distance from the device	10 mrem/hr at 1 meter (3.3 ft)	10 mrem/hr at 1 meter (3.3 ft)
Distance in ft to secretary's chair	12 ft	18 ft



## F. Example 1: Part 1

1. Joe's first thought is that the distance between the devices and the secretary's chair may be sufficient to show compliance with the regulation in 10 CFR 20.1301. So, taking a worst case approach, he assumes: 1) the devices are constantly present (i.e., 24 hr/d), 2) both devices remain in storage with no other use, and 3) the secretary is constantly sitting in the desk chair (i.e., 24 hr/d). Joe proceeds to calculate the dose she might receive hourly and yearly from each device, as shown in **Tables 9 and 10** below.

**G. Table 9: Calculational Method, Part 1: Hourly and Annual Dose Received from Device 1**

Step No.	Description	Device 1 Input Data	Results
1	Dose received in an hour at known distance from device (e.g., from manufacturers data), in mrem/hr	10	10
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft <sup>2</sup>	(3.3) <sup>2</sup>	10.9
3	Square of the distance (ft) from the device the secretary's desk in an unrestricted area, in ft <sup>2</sup>	(12) <sup>2</sup>	144
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	10 x 10.9	109
5	Divide the result of Step 4 by the result of Step 3 to calculate the dose received by an individual at the secretary's desk, HOURLY DOSE RECEIVED FROM DEVICE 1, in mrem in an hour.	109/144	0.76
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICE 1, in mrem in a year.	0.76 x 24 x 365	6,630

**H. Table 10: Calculational Method, Part 1: Hourly and Annual Dose Received from Device 2**

Step No.	Description	Device 1 Input Data	Results
1	Dose received in an hour at known distance from device (e.g., from manufacturers data), in mrem/hr	10	10
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft <sup>2</sup>	(3.3) <sup>2</sup>	10.9
3	Square of the distance (ft) from the device the secretary's desk in an unrestricted area, in ft <sup>2</sup>	(18) <sup>2</sup>	324
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	10 x 10.9	109
5	Divide the result of Step 4 by the result of Step 3 to calculate the dose received by an individual at the secretary's desk, HOURLY DOSE RECEIVED FROM DEVICE 2, in mrem in an hour.	109/324	0.34
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICE 2, in mrem in a year.	0.34 x 24 x 365	2,950

**I. To determine the total hourly and total annual dose received, Joe adds the pertinent data from the preceding tables.**

**1. Table 11: Calculational Method, Part 1: Total Hourly and Annual Dose Received from Devices 1 and 2**

Step No.	Description	Device 1	Device 2	Sum
7	TOTAL HOURLY DOSE RECEIVED from Step 5 of <b>Tables 9</b> and <b>10</b> , in mrem in an hour	0.76	0.34	$0.76 + 0.34 = 1.1$
8	TOTAL ANNUAL DOSE RECEIVED from Step 6 of <b>Tables 9</b> and <b>10</b> , in mrem in a year	6,630	2,950	9,580

**Note:** The Sum in Step 7 demonstrates compliance with the limit of 2 mrem in any one hour. Reevaluate if assumptions change. If the Sum in Step 8 exceeds 100 mrem/yr, proceed to Part 2 of the calculational method. At this point, Joe is pleased to see that the total dose that an individual could receive in any one hour is only 1.1 mrem in an hour, but notes that an individual could receive a dose of 9,580 mrem in a year, much higher than the 100 mrem limit.

**J. Example 1: Part 2**

- Joe reviews his assumptions and recognizes that the secretary is not at the desk 24 hr/d. He decides to make a realistic estimate of the number of hours the secretary sits in the chair at the desk, keeping his other assumptions constant (i.e., the devices are constantly present (i.e., 24 hr/d), both devices remain in storage with no other use). He then recalculates the annual dose received.

**2. Table 12: Calculational Method, Part 2: Annual Dose Received from Devices 1 and 2**

Step No.	Description	Results
9	A. Average number of hours per day that individual spends in area of concern (e.g., secretary sits at desk 5 hr/day; the remainder of the day the secretary is away from the desk area copying, filing, etc.) B. Average number of days per week in area (e.g., secretary is part time and works 3 days/week) C. Average number of weeks per year in area (e.g., secretary works all year )	5 3 52
10	Multiply the results of Step 9.A. by the results of Step 9.B. by the results of Step 9.C. = AVERAGE NUMBER OF HOURS IN AREA OF CONCERN PER YEAR	$5 \times 3 \times 52 = \mathbf{780}$
11	Multiply the sum in Step 7 by the results of Step 10 = ANNUAL DOSE RECEIVED FROM DEVICES CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN, in mrem in a year	$1.1 \times 780 = \mathbf{860}$

**Note:** If Step 11 exceeds 100 mrem in a year, proceed to Part 3 of the calculational method.

3. Although Joe is pleased to note that the calculated annual dose received is significantly lower, he realizes it still exceeds the 100 mrem in a year limit.

#### **K. Example 1, Part 3**

1. Again Joe reviews his assumptions and recognizes that the devices are not always in storage when the secretary is seated at the desk. As he examines the situation, he realizes he must consider each device individually.

#### **2. Table 13: Calculational Method, Part 3: Summary of Information**

Summary
Information on When Devices Are Present in the Storage Area:
<ul style="list-style-type: none"><li>• <b>Device 1:</b> an Ir-192 Exposure Device Located in the Storage Area Overnight; it Is Used Every Day at Temporary Jobsites All Year and Returned to the Storage Location at the End of Each Day. The Device Is Usually Present During the Secretary's First and Last Hours of Work Each Day.</li><li>• <b>Device 2:</b> a Co-60 Exposure Device Located in the Storage Area Continuously (24 Hr/d) for 8 Months of the Year; for the Remaining 4 Months of the Year, it Is at Temporary Jobsites</li></ul>
Information from Example 1, Part 2 on When the Secretary Is Sitting at the Desk:
<ul style="list-style-type: none"><li>• 5 Days per Week</li><li>• 3 Days per Week</li><li>• 52 Weeks per Year</li></ul>

### 3. Table 14: Calculational Method, Part 3: Annual Dose Received from Devices 1 and 2

Step No.	Description	Device 1	Device 2
12	Average number of hours per day device is in storage while secretary is present	2	5
13	Average number of days per week device is in storage while secretary is present	3	3
14	Average number of weeks per year device is in storage while secretary is present	52	32
15	Multiply the results of Step 12 by the results of Step 13 by the results of Step 14 = TOTAL HOURS EACH DEVICE IS STORED PER YEAR WHILE SECRETARY IS PRESENT	$2 \times 3 \times 52 = 312$	$5 \times 3 \times 32 = 480$
16	Multiply the results of Step 15 by the results of Step 7 = ANNUAL DOSE RECEIVED FROM EACH DEVICE, in mrem in a year	$312 \times 0.76 = 237$	$480 \times 0.34 = 163$
17	Sum the results of Step 16 for each device = TOTAL ANNUAL DOSE RECEIVED CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN AND TIME DEVICE IS IN STORAGE, in mrem in a year	$237 + 163 = 400$	

**Note:** If the result in Step 17 is greater than 100 mrem/yr, the licensee must take corrective actions.

4. Joe notes that the result in Step 17 does not show compliance with the 100 mrem/yr limit. Since the result in Step 17 is higher than 100 mrem/yr, then Joe has to consider one or more of the following:

- Consider whether the assumptions used to determine occupancy and the time each device is in storage are accurate, revise the assumptions as needed, and recalculate using the new assumptions.
- Calculate the effect of any shielding located between the device storage area and the secretarial workstation. Listed below are typical half-value layers (HVL) for Ir-192 and Co-60.

### 5. Table 15: Half Value Layers (HVL) for Typical Shielding Materials

	Steel	HVL (inches) Lead	Concrete
Ir-192	0.5	0.25	1.7
Co-60	0.8	0.5	2.1

- Take corrective action (e.g., move devices within storage area, move the storage area, move the secretarial workstation) and perform new calculations to demonstrate compliance.
- Designate the area outside the storage area as a restricted area and the secretary as an occupationally exposed individual. This would require controlling access to the area for purposes of radiation protection and training the secretary as required by 10 CFR 19.12.

## L. Example 1, Part 4

1. Joe decides to take into account the amount of shielding provided by the wall between the secretary's desk and the storage area where the two devices are located. The wall between the secretary's office and the storage area is a 4 inch thick concrete fire wall.

**2. Table 16: Calculational Method, Part 4: Annual Dose Received from Devices 1 and 2**

Step No.	Description	Device 1	Device 2
18	Annual dose received from each device from Step 15	237	163
19	Number of HVLs (Thickness of shielding material/Thickness for one HVL); If more than one shielding material, need to evaluate each shielding material separately by type of radionuclide	$4.0/1.7 = 2.35$	$4.0/2.1 = 1.9$
20	Fraction of radiation dose transmitted through shield: 0.5 (Total Number of HVLs); If more than one shielding material, then sum the number results from Step 19 by radionuclide	$0.5(2.35) = 0.2$	$0.5(1.9) = 0.27$
21	Multiply the results of Step 20 by the results of Step 18 = ANNUAL DOSE RECEIVED FROM EACH DEVICE, in mrem in a year	$0.2 \times 237 = 47$	$0.27 \times 163 = 44$
22	Sum the results of Step 21 for each device = TOTAL ANNUAL DOSE RECEIVED CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN, TIME DEVICE IS IN STORAGE AND SHIELDING OF STRUCTURAL MATERIALS, in mrem in a Year	$47 + 44 = \mathbf{91}$	

**Note:** If the result in Step 22 is greater than 100 mrem/yr, the licensee must take corrective actions.

3. Joe is glad to see that the results in Step 22 show compliance with the 100 mrem in a calendar year limit.
4. Note that in the example, Joe evaluated the unrestricted area outside only one wall of the device storage area. Licensees also need to make similar evaluations for other unrestricted areas and to keep in mind the ALARA principal, taking reasonable steps to keep radiation dose received below regulatory requirements. In addition, licensees need to be alert to changes in situations (e.g., moving any of the devices closer to the secretarial workstation, adding a device to the storage area, changing the secretary to a full-time worker, or changing the estimate of the portion of time spent at the desk) and to perform additional evaluations, as needed.

RECORD KEEPING: <i>HFS 157.31(8)</i> requires licensees to maintain records demonstrating compliance with the dose limits for individual members of the public.
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## M. Combination Measurement - Calculational Method

1. This method, which allows the licensee to take credit for shielding between the device and the area in question, begins by measuring radiation levels in the areas, as opposed to using manufacturer-supplied rates at a specified distance from each device. These measurements must be made with calibrated survey meters sufficiently sensitive to measure background levels of radiation. However, licensees must exercise caution when making measurements with currently calibrated radiation survey instruments. A maximum dose of 1 mSv (100 mrem) received by an individual over an interval of 2080 hours (i.e., a work year of 40 hr/wk for 52 wk/yr) is equal to less than 0.5 microsievert (0.05 mrem) per hour.

This rate is well below the minimum sensitivity of most commonly available G-M survey instruments.
--

2. Instruments used to make measurements for calculations must be sufficiently sensitive. An instrument equipped with a scintillation-type detector (e.g., NaI(Tl)) or a micro-R meter used in making very low gamma radiation measurements should be adequate.
3. Licensees may also choose to use environmental TLDs. TLDs used for personnel monitoring (e.g., LiF) may not have sufficient sensitivity for this purpose. Generally, the minimum reportable dose received is 0.1 mSv (10 mrem). Suppose a TLD monitors dose received and is changed once a month. If the measurements are at the minimum reportable level, the annual dose received could have been about 1.2 mSv (120 mrem), a value in excess of the 1 mSv/yr (100 mrem/yr) limit. If licensees use TLDs to evaluate compliance with the public dose limits, they should consult with their TLD supplier and choose more sensitive TLDs, such as those containing CaF<sub>2</sub> that are used for environmental monitoring. in unrestricted areas next to the device storage area for monitoring. This direct measurement method would provide a definitive measurement of actual radiation levels in unrestricted areas without any restrictive assumptions. Records of these measurements can then be evaluated to ensure that rates in unrestricted areas do not exceed the 1 mSv/yr (100 mrem/yr) limit.

## N. Example 2

1. As in Example 1, Joe is the RSO for Mo-Rad, Inc., a radiography licensee. The company has two devices stored in a designated, locked storage area that adjoins an unrestricted area where a secretarial workstation is located. See **Figure 13** and **Table 8** for information. Joe wants to see if the company complies with the public dose limits at the secretarial station.

2. During the winter while all the devices were in storage, Joe placed an environmental TLD badge in the secretarial workspace for 30 days. Joe chose a winter month so he did not have to keep track of the number of hours that each device was in the storage area. The TLD processor sent Joe a report indicating the TLD received 100 mrem.

3. Parts 2 and 3 are the calculated the same as Example 1.

**4. Table 17: Combination Measurement - Calculational Method**

Step No.	Description	Input Data and Results
<b>Part 1</b>		
1	Dose received by TLD, in mrem	100
2	Total hours TLD exposed	224 hr/d x 30 d/month = 720
3	Divide the results of Step 1 by the results of Step 2 to determine HOURLY DOSE RECEIVED, in mrem in an hour	0.14
4	Multiply the results of Step 3 by 365 d/yr x 24 hr/d = 8760 hours in one year = MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICES, in mrem in a year	365 x 24 x 0.14 = 8760 x 0.14 = 1226
<b>Part 2</b>		
<b>Part 3</b>		

**Note:** For the conditions described above, Step 3 indicates that the dose received in any one hour is less than the 2 mrem in any one hour limit. However, if there are any changes, then the licensee would need to reevaluate the potential doses which could be received in any one hour. Step 4 indicates that the annual dose received would be much greater than the 100 mrem in a year allowed by the rule.

5. In Step 2, Joe can adjust for a realistic estimate of the time the secretary spends in the area as he did in Part 2 of Example 1.

6. If the results of Joe's evaluation in Part 2 show that the annual dose received in a year exceeds 100 mrem, then he can make adjustments for realistic estimates of the time spent in the area of concern while the devices are actually in storage as in Part 3 of Example 1. (Recall that the TLD measurement was made while all the devices were in storage -- i.e., 24 hr/d for the 30 days that the TLD was in place.)

## **Appendix M:**

# **Information for Applicants to Consider When Developing Procedures for Operating Radiography Equipment**



## **A. Crank-out Device**

1. Locate the source shield at the desired distance from the object to be radiographed.
2. Mount the source tip firmly, using jigs or other attachments, with the tip in the exact exposure position.
3. Locate the control unit at the maximum distance (25 feet or 7.6 meters) from the source shield with the control tubes laid out as straight as possible.
4. Join the control cable to the unit following the manufacturer's instructions.
5. Establish and post the restricted area and high radiation area.
6. Unlock the device.
7. Turn the hand crank steadily to move the source out of the source shield to the exposure position.
8. Survey the perimeter of the restricted area to be sure that radiation levels do not exceed 0.02 mSv (2 mrem) in any one hour.
9. Maintain continuous surveillance over the restricted area during an exposure, keeping all persons from entering.
10. After completing the exposure, retract the source by turning the crank until the "safe" position is indicated.
11. Survey the entire circumference of the device and the guide tube to determine that the source is in a shielded position.
12. Lock the device and remove the key.

## **B. Pipeliner Device**

1. Establish and post the restricted area and high radiation area.
2. Unlock the device.
3. Stand as far away as possible and out of the direction of the beam and expose the source (e.g., use the "stretch technique").
4. Survey the perimeter of the restricted area to be sure that the radiation levels do not exceed 0.02 mSv (2 mrem) in any one hour.
5. Maintain continuous surveillance over the restricted area during an exposure, keeping all persons from entering.
6. After completing the exposure, return the source to the shielded position.
7. Survey the device to determine that the source is in a shielded position.
8. Lock the device.

**Note:** DHFS considers the following very important: surveys of the restricted area, continuous surveillance of the restricted area during an exposure, the survey of the device and guide tube, and locking the device.

## C. Source Exchange

### 1. Removing the Old Source

Caution: Always use a calibrated, operable survey meter while performing a source exchange!

- a. Survey the shipping container upon receipt with a survey meter. Note that the surface reading should not exceed 2 mSv/hr (200 mem/hr).
- b. Attach the end of the source guide tube to the exposure device.
- c. Connect the other end of the source guide tube to the empty side of the source changer.
- d. Unlock the empty side of the source changer.
- e. Unlock the camera and crank out the source from the camera into the source changer.
- f. Survey the source changer and guide tube to verify that the source is in the safe position.
- g. Lock the source changer.
- h. Disconnect the source guide tube and drive cable to the source pigtail. Replace the dust cap on the source changer.
- i. Remove the source identification plate from the exposure device and affix the plate to the side of the source changer loaded with the old source.

### 2. Installing the New Source

- a. Remove the dust cap on the source changer lock body identified with the new source tag.
- b. Align the camera and source guide tube with the source changer.
- c. Connect the new source to the drive cable.
- d. Connect the source guide tube to the source changer.
- e. Unlock the source changer and retract the new source into the exposure device.
- f. Survey the exposure device and guide tube to assure that the source is in the safe position.
- g. Lock the exposure device.
- h. Disconnect the source guide tube and drive accessories.
- i. Affix the new source identification plate on the exposure device.

# **Appendix N:**

# **Transportation**

The following are the major areas in DOT regulations most relevant for transporting radiographic exposure devices and source exchangers that are shipped as Type B quantities are:

A. Table of Hazardous Materials and Special Provisions [**49 CFR 172.101**]

1. **49 CFR 172.101** - Hazardous Materials Table [proper shipping name, hazard class, identification number]
2. **Table 2, Appendix A, 49 CFR 172.101** - List of Hazardous Substances and Reportable Quantities [for radionuclides]

B. Shipping Papers - **49 CFR 172.200**

1. **49 CFR 172.201** - General entries [on shipping papers]
2. **49 CFR 172.202** - Description of hazardous material on shipping papers
3. **49 CFR 172.203** - Additional description requirements
4. **49 CFR 172.204** - Shipper's certification [if applicable]

C. Package Markings - **49 CFR 172.300**

1. **49 CFR 172.301** - General marking requirements for non-bulk packaging
2. **49 CFR 172.304** - Marking requirements
3. **49 CFR 172.310** - Radioactive material [Type B]
4. **49 CFR 172.324** - Hazardous substances in non-bulk packaging [designation of "reportable quantities" with the letters "RQ"]

D. Package Labeling - **49 CFR 172.400**

1. **49 CFR 172.400(a)** - General labeling requirements
2. **49 CFR 172.403** - Radioactive materials [types and contents of labels]
3. **49 CFR 172.406** - Placement of labels

E. Placarding of Vehicles - **49 CFR 172.500**

1. **49 CFR 172.504** - General placarding requirements
2. **49 CFR 172.516** - Visibility and display of placards
3. **49 CFR 172.556** - RADIOACTIVE placard

F. Emergency Response Information - **Subpart G**

1. **49 CFR 172.600** - Applicability and general requirements
2. **49 CFR 172.602** - Emergency response information
3. **49 CFR 172.604** - Emergency response telephone number

#### G. Training - **Subpart H**

1. **49 CFR 172.702** - Applicability and responsibility for training and testing [for HAZMAT employees]
2. **49 CFR 172.702** - Training requirements (includes types of training, when it must be conducted, need for refresher training every 3 years, recordkeeping)

#### H. Shippers - General Requirements for Shipments and Packaging - **49 CFR 173**

1. **49 CFR 173.25** - Requirements for use and labeling of overpacks
2. **49 CFR 173.403** - Definitions
3. **49 CFR 173.411** - General design requirements
4. **49 CFR 173.413** - Additional design requirements for Type B packages
5. **49 CFR 173.416** - Authorized Type B packages [includes packaging certification requirements]
6. **49 CFR 173.441** - Radiation levels
7. **49 CFR 173.471** - Additional requirements for Type B packages approved by NRC
8. **49 CFR 173.476** - Approval of special form radioactive materials [includes requirement for documentation of special form status]



#### I. Carriage by Public Highway - **49 CFR 177**

1. **49 CFR 177.817** - Shipping paper [location of shipping papers during transport]
2. **49 CFR 177.842** - Class 7 (radioactive) material [includes requirement for blocking and bracing during transport]

## J. Hazard Communications for Class 7 (Radioactive) Materials

<b>Hazard Communications for Class 7 (Radioactive) Materials</b> <b>DOT Shipping Papers (49 CFR 172.200-205)</b> NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials		
Entries Always Required Unless Excepted	Additional Entries Sometimes Required	Optional Entries
<ul style="list-style-type: none"> <li>The basic description, in sequence: <b>Proper Shipping Name, Hazard Class (7), U.N. Identification Number</b></li> <li><b>24 hour emergency response telephone number</b></li> <li><b>Name of shipper</b></li> <li>Proper page numbering (Page 1 of 4)</li> <li>Except for empty and bulk packages, the <b>total quantity</b> (mass, or volume for liquid), in appropriate units (lbs, mL....)</li> <li>If not special form, <b>chemical and physical form</b></li> <li>The <b>name of each Radionuclides</b> (95% rule) and total package activity. The activity must be in SI units (e.g., Bq, TBq), or both SI units and customary units (e.g., Ci, mCi). However, for <u>domestic shipments</u>, the activity may be expressed in terms of customary units only, until 4/1/97.</li> <li>For each labeled package:               <ul style="list-style-type: none"> <li>The <b>category of label</b> used;</li> <li>The <b>transport index</b> of each package with a Yellow-II or Yellow-III label</li> </ul> </li> <li>Shipper's <b>certification</b> (not required of private carriers)</li> </ul>	<p><u>Materials-Based Requirements:</u></p> <ul style="list-style-type: none"> <li>If hazardous substance, "RQ" as part of the basic description</li> <li>The LSA or SCO group (e.g., LSA-II)</li> <li>"Highway Route Controlled Quantity" as part of the basic description, if HRCQ</li> <li>Fissile material information (e.g., "Fissile Exempt," controlled shipment statement [see §172.203(d)(7)])</li> <li>If the material is considered hazardous waste and the word waste does not appear in the shipping name, then "waste" must precede the shipping name (e.g., Waste Radioactive Material, nos, UN2982)</li> <li>"Radioactive Material" if not in proper shipping name</li> </ul> <p><u>Package-Based Requirements:</u></p> <ul style="list-style-type: none"> <li>Package identification for DOT Type B or NRC certified packages</li> <li>IAEA CoC ID number for export shipments or shipments using foreign-made packaging (see §173.473)</li> </ul> <p><u>Administrative-Based Requirements:</u></p> <ul style="list-style-type: none"> <li>"Exclusive Use-Shipment"</li> <li>Instructions for maintenance of exclusive use-shipment controls for LSA/SCO strong-tight or NRC certified LSA (§ 173.427)</li> <li>If a DOT exemption is being used, "DOT-E" followed by the exemption number</li> </ul>	<ul style="list-style-type: none"> <li>The type of packaging (e.g., Type A, Type B, IP-1, ....)</li> <li>The Technical/chemical name may be included (if listed in §172.203(k), in parentheses between the proper shipping name and hazard class; otherwise inserted in parenthesis after the basic description)</li> <li>Other information is permitted (e.g., functional description of the product), provided it does not confuse or detract from the proper shipping name or other required information</li> <li>For fissile radionuclides, except Pu-238, Pu-239, and Pu-241, the weight in grams or kilograms may be used <i>in place of</i> activity units. For Pu-238, Pu-239, and Pu-241, the weight in grams or kilograms may optionally be entered <i>in addition to</i> activity units [see § 172.203(d)(4)]</li> <li>Emergency response hazards and guidance information (§§ 172.600-604) may be entered on the shipping papers, or may be carried with the shipping papers [§ 172.602(b)]</li> </ul>
Some Special Considerations/Exceptions for Shipping Paper Requirements		
<ul style="list-style-type: none"> <li>Shipments of Radioactive Material, excepted packages, under UN2910 (e.g., Limited Quantity, Empty packages, and Radioactive Instrument and Article), are excepted from shipping papers. For limited quantities (§173.421), this is only true if the limited quantity is not a hazardous substance (RQ) or hazardous waste (40 CFR 262)</li> <li>Shipping papers must be in the pocket on the left door, or readily visible to person entering driver's compartment and within arm's reach of the driver</li> <li>For shipments of multiple cargo types, any HAZMAT entries must appear as the first entries on the shipping papers, be designated by an "X" (or "RQ") in the hazardous material column, <u>or</u> be highlighted in a contrasting color</li> </ul>		

## K. Marking Packages(49 CFR 172.200-205)

Hazard Communications for Class 7 (Radioactive) Materials		
Marking Packages (49 CFR 172.300-338)		
NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments. This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.		
Markings Always Required Unless Excepted	Additional Markings Sometimes Required	Optional Markings
<p><u>Non-Bulk Packages</u></p> <ul style="list-style-type: none"> <li>Proper shipping name</li> <li>U.N. identification number</li> <li>Name and address of consignor or consignee, <i>unless</i>: <ul style="list-style-type: none"> <li>highway only and no motor carrier transfers, <i>or</i></li> <li>part of carload or truckload lot or freight container load, and entire contents of railcar, truck, or freight container are shipped from one consignor to one consignee [see §172.301(d)]</li> </ul> </li> </ul> <hr/> <p><u>Bulk Packages</u> (i.e., net capacity greater than 119 gallons as a receptacle for liquid, or 119 gallons and 882 pounds as a receptacle for solid, or water capacity greater than 1000 lbs, with no consideration of intermediate forms of containment)</p> <ul style="list-style-type: none"> <li>U.N. identification number, on orange, rectangular panel (see §172.332) - some exceptions exist</li> </ul>	<p><u>Materials-Based Requirements:</u></p> <ul style="list-style-type: none"> <li>If in excess of 110 lbs (50 kg), Gross Weight</li> <li>If non-bulk <u>liquid</u> package, underlined double arrows indicating upright orientation (two opposite sides) [ISO Std 780-1985 marking] </li> <li>If a Hazardous substance in non-bulk package, the letters "RQ" in association with the proper shipping name</li> </ul> <p><u>Package-Based Requirements:</u></p> <ul style="list-style-type: none"> <li>The package type if Type A or Type B (½" or greater letters)</li> <li>The specification-required markings [e.g., for Spec. 7A packages: "DOT 7A Type A" and "Radioactive Material" (see §178.350-353)]</li> <li>For approved packages, the certificate ID number (e.g., USA9166/B(U), USA9150/B(U)-85, ...)</li> <li>If Type B, the trefoil (radiation) symbol per Part 172 App. B [size: outer radius ≥ 20 mm (0.8 in)] </li> <li>For NRC certified packages, the model number, gross weight, and package ID number (10 CFR 71.85)</li> </ul> <p><u>Administrative-Based Requirements:</u></p> <ul style="list-style-type: none"> <li>If a DOT exemption is being used, "DOT-E" followed by the exemption number</li> <li>If an export shipment, "USA" in conjunction with the specification markings or certificate markings</li> </ul>	<ul style="list-style-type: none"> <li>"IP-1," "IP-2," or "IP-3" on industrial packaging is recommended</li> <li>Both the name and address of consignor and consignee are recommended</li> <li>Other markings (e.g., advertising) are permitted, but must be sufficiently away from required markings and labeling</li> </ul>
Some Special Considerations/Exceptions for Marking Requirements		
<ul style="list-style-type: none"> <li>Marking is required to be: (1) durable, (2) printed on a package, label, tag, or sign, (3) unobscured by labels or attachments, (4) isolated from other marks, and (5) be representative of the hazmat contents of the package</li> <li>Limited Quantity (§173.421) packages and Articles Containing Natural Uranium and Thorium (§173.426) must bear the marking "radioactive" on the outside of the inner package or the outer package itself, and are excepted from other marking. The excepted packages shipped under UN 2910 must also have the accompanying statement that is required by §173.422.</li> <li>Empty (§173.428) and Radioactive Instrument and Article (§173.424) packages are excepted from marking</li> <li>Shipment of LSA or SCO required by §173.427 to be consigned as exclusive use are excepted from marking except that the exterior of each nonbulk package must be marked "Radioactive-LSA" or "Radioactive-SCO," as appropriate. Examples of this category are domestic, strong-tight containers with less than an A<sub>2</sub> quantity, and domestic NRC certified LSA/SCO packages using 10 CFR 71.52.</li> <li>For bulk packages, marking may be required on more than one side of the package (see 49 CFR 172.302(a))</li> </ul>		

## L. Labeling Packages (49 CFR 172.400- 450)

### Hazard Communications for Class 7 (Radioactive) Materials




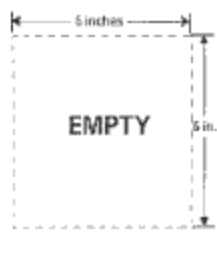
#### Labeling Packages (49 CFR 172.400-450)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments. This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.

#### Placement of Radioactive Labels

- Labeling is required to be: (1) placed near the required marking of the proper shipping name, (2) printed or affixed to the package surface (not the bottom), (3) in contrast with its background, (4) unobscured by markings or attachments, (5) within color, design, and size tolerance, and (6) representative of the HAZMAT contents of the package.
- For labeling of radioactive materials packages, two labels are required on opposite sides excluding the bottom.

#### Determination of Required Label

<b>Size:</b> Sides: $\geq 100$ mm (3.9 in.)  <b>Border:</b> 5-6.3 mm (0.2-0.25 in.)	 49 CFR 172.436	 49 CFR 172.438	 49 CFR 172.440	 49 CFR 172.450
<b>Label</b>	<b>WHITE-I</b>	<b>YELLOW-II</b>	<b>YELLOW-III</b>	<b>EMPTY LABEL</b>
<b>Required when:</b>	Surface radiation level $< 0.005$ mSv/hr (0.5 mrem/hr)	0.005 mSv/hr (0.5 mrem/hr) $<$ surface radiation level $\leq 0.5$ mSv/hr (50 mrem/hr)	0.5 mSv/hr (50 mrem/hr) $<$ surface radiation level $< 2$ mSv/hr (200 mrem/h) [Note: 10 mSv/hr (1000 mrem/hr) for exclusive-use closed vehicle (§173.441(b))]	The EMPTY label is required for shipments of empty Class 7 (radioactive) packages made pursuant to §173.428. It must cover any previous labels, or they must be removed or obliterated.
<b>Or:</b>	$TI = 0$ [1 meter dose rate $< 0.0005$ mSv/hr (0.05 mrem/hr)]	$TI \leq 1$ [1 meter dose rate $< 0.01$ mSv/hr (1 mrem/hr)]	$TI \leq 10$ [1 meter dose rate $< 0.1$ mSv/hr (10 mrem/hr)] [Note: There is no package TI limit for exclusive-use]	
<b>Notes:</b>	<ul style="list-style-type: none"> <li>Any package containing a Highway Route Controlled Quantity (HRCQ) must bear YELLOW-III label</li> <li>Although radiation level transport indices (TIs) are shown above, for fissile material, the TI is typically determined on the basis of criticality control</li> </ul>			

#### Content on Radioactive Labels

- RADIOACTIVE Label must contain (entered using a durable, weather-resistant means):
  - The radionuclides in the package (with consideration of available space). Symbols (e.g., Co-60) are acceptable.
  - The activity in SI units (e.g., Bq, TBq), or both SI units with customary units (e.g., Ci, mCi) in parenthesis. However, for domestic shipments, the activity may be expressed in terms of customary units only, until 4/1/97.
  - The Transport Index (TI) in the supplied box. The TI is entered only on YELLOW-II and YELLOW-III labels.

#### Some Special Considerations/Exceptions for Labeling Requirements

- For materials meeting the definition of another hazard class, labels for each secondary hazard class need to be affixed to the package. The subsidiary label may not be required on opposite sides, and must not display the hazard class number.
- Radioactive Material, excepted packages, under UN2910 (e.g., Limited Quantity, Empty packages, and Radioactive Instrument and Article), are excepted from labeling. However, if the excepted quantity meets the definition for another hazard class, it is re-classed for that hazard. Hazard communication requirements for the other class are required.
- Labeling exceptions exist for shipment of LSA or SCO required by § 173.427 to be consigned as exclusive use.
- The "Cargo Aircraft Only" label is typically required for radioactive materials packages shipped by air [§ 172.402(c)].



## M. Placarding Vehicles (49 CFR 172.500-560)

### Hazard Communications for Class 7 (Radioactive) Materials

#### Placarding Vehicles (49 CFR 172.500-560)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments. This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.




#### Visibility and Display of Radioactive Placard

- Placards are required to be displayed:
  - on four sides of the vehicle
  - visible from the direction they face, (for the front side of trucks, tractor-front, trailer, or both are authorized)
  - clear of appurtenances and devices (e.g., ladders, pipes, tarpaulins)
  - at least 3 inches from any markings (such as advertisements) which may reduce placard's effectiveness
  - upright and on-point such that the words read horizontally
  - in contrast with the background, or have a lined-border which contrasts with the background
  - such that dirt or water from the transport vehicle's wheels will not strike them
  - securely attached or affixed to the vehicle, or in a holder.
- Placard must be maintained by carrier to keep color, legibility, and visibility.

#### Conditions Requiring Placarding

- Placards are required for any vehicle containing package with a RADIOACTIVE Yellow-III label
- Placards are required for shipment of LSA or SCO required by §173.427 to be consigned as exclusive use. Examples of this category are domestic, strong-tight containers with less than an  $A_2$  quantity, and domestic NRC certified LSA/SCO packages using 10 CFR 71.52. Also, for bulk packages of these materials, the orange panel marking with the UN Identification number is not required.
- Placards are required any vehicle containing package with a Highway Route Controlled Quantity (HRCQ). In this case, the placard must be placed in a square background as shown below (see §173.507(a))

#### Radioactive Placard

<p><b>Size Specs:</b></p> <p>Sides: &gt; 273 mm (10.8 in.)</p> <p>Solid line Inner border: About 12.7 mm (0.5 in.) from edges</p> <p>Lettering: &gt; 41 mm (1.6 in.)</p> <p>Square for HRCQ: 387mm (15.25 in.) outside length by 25.4 mm (1 in.) thick</p>	 <p>49 CFR 172.556</p> <p><b>RADIOACTIVE PLACARD (Domestic)</b></p> <p>Base of yellow solid area: 29 ± 5 mm (1.1 ± 0.2 in.) above horizontal centerline</p>	 <p>IAEA SS 6 (1985) paras. 443-444</p> <p><b>RADIOACTIVE PLACARD (International)</b></p>	 <p>See 49 CFR 172.527 AND 556</p> <p><b>RADIOACTIVE PLACARD FOR HIGHWAY ROUTE CONTROLLED QUANTITY</b> (either domestic or international placard could be in middle)</p>
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#### Some Special Considerations/Exceptions for Placarding Requirements

- Domestically, substitution of the UN ID number for the word "RADIOACTIVE" on the placard is prohibited for Class 7 materials. However, some import shipments may have this substitution in accordance with international regulations.
- Bulk packages require the orange, rectangular panel marking containing the UN ID number, which must be placed adjacent to the placard (see §172.332) (NOTE: except for LSA/ SCO exclusive use under §173.427, as above)
- If placarding for more than one hazard class, subsidiary placards must not display the hazard class number. Uranium Hexafluoride ( $UF_6$ ) shipments ≥ 454 kg (1001 lbs) require both RADIOACTIVE and CORROSIVE (Class 8) placarding
- For shipments of radiography cameras in convenience overpacks, if the overpack does not require a RADIOACTIVE - YELLOW III label, vehicle placarding is not required (regardless of the label which must be placed on the camera)

## 1. Minimum Required Packing for Class 7 (Radioactive) Materials

Minimum Required Packaging For Class 7 (Radioactive) Materials This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials				
Quantity:	< 70 Bq/g ( $< 0.002 \text{ Ci/g}$ )	Limited Quantity (§173.421)	A <sub>1</sub> /A <sub>2</sub> value (§173.435)	1 rem/hr at 3 m, unshielded (§173.427)
Non-LSA/SCO:	Excepted	Type A	Type B <sup>3</sup>	
Domestic or International LSA/SCO: LSA-I solid, (liquid) <sup>1</sup> SCO-I	Excepted	IP-I	Type B <sup>3</sup>	
LSA-I Liquid LSA-II Solid, (liquid or gas) <sup>1</sup> (LSA-III) <sup>1</sup> SCO-II		IP-II	Type B <sup>3</sup>	
LSA-II Liquid or Gas LSA-III		IP-III	Type B <sup>3</sup>	
Domestic (only) LSA/SCO: LSA-I, II, III; SCO-I, II	Excepted	Strong-tight <sup>2</sup>	DOT Spec. 7A Type A	Type B <sup>3</sup> NRC Type A LSA <sup>3,4</sup>

- For entries in parentheses, exclusive use is required for shipment in an IP (e.g., shipment of LSA-I liquid in an IP-I packaging would require exclusive use consignment)
- Exclusive use required for strong-tight container shipments made pursuant to §173.427(b)(2)
- Subject to conditions in Certificate, if NRC package
- Exclusive use required, see §173.427(b)(4). Use of these packages expires on 4/1/99 (10 CFR 71.52)

Package and Vehicle Radiation Level Limits (49 CFR 173.441) <sup>A</sup>				
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials:				
Transport Vehicle Use:	Non-Exclusive	Exclusive		
Transport Vehicle Type:	Open or Closed	Open (flat-bed)	Open w/Enclosure <sup>B</sup>	Closed
Package (or freight container) Limits:				
External Surface	2 mSv/hr (200 mrem/hr)	2 mSv/hr (200 mrem/hr)	10 mSv/hr (1000 mrem/hr)	10 mSv/hr (1000 mrem/hr)
Transport Index (TI) <sup>C</sup>	10	no limit		
Roadway or Railway Vehicle (or freight container) Limits:				
Any point on the outer surface	N/A	N/A	N/A	2 mSv/hr (200 mrem/hr)
Vertical planes projected from outer edges		2 mSv/hr (200 mrem/hr)	2 mSv/hr (200 mrem/hr)	N/A
Top of...		load: (200 mrem/hr)	enclosure: 2 mSv/hr (200 mrem/hr)	vehicle: 2 mSv/hr (200 mrem/hr)
2 meters from...		vertical planes: 0.1 mSv/hr (10 mrem/hr)	vertical planes: 0.1 mSv/hr (10 mrem/hr)	outer lateral surfaces: 0.1 mSv/hr (10 mrem/hr)
Underside	N/A <sup>D</sup>	2 mSv/hr (200 mrem/hr)		
Occupied position		0.02 mSv/hr (2 mrem/hr) <sup>E</sup>		
Sum of package TI's		no limit <sup>F</sup>		

A. The limits in this table do not apply to excepted packages - see 49 CFR 173.421-426

B. Securely attached (to vehicle), access-limiting enclosure; package personnel barriers are considered as enclosures

C. For nonfissile radioactive materials packages, the dimensionless number equivalent to maximum radiation level at 1 m (3.3 feet) from the exterior package surface, in millirem/hour

D. No dose limit is specified, but separation distances apply to Radioactive Yellow-II or Radioactive Yellow-III labeled packages

E. Does not apply to private carrier wearing dosimetry if under radiation protection program satisfying 10 CFR 20 or 49 CFR 172 Subpart I

F. Some fissile shipments may have combined conveyance TI limit of 100 - see 10 CFR 71.59 and 49 CFR 173.457

## N. Package and Vehicle Contamination Limits (49 CFR 173.443)

Package and Vehicle Contamination Limits (49 CFR 173.443)		
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials		
NOTE: All values for contamination in DOT rules are to be averaged over each 300 cm <sup>2</sup> Sufficient measurements must be taken in the appropriate locations to yield representative assessments		
&( means the sum of beta emitters, gamma emitters, and low-toxicity alpha emitters " means the sum of all other alpha emitters (i.e., other than low-toxicity alpha emitters)		
The Basic Contamination Limits for All Packages: 49 CFR 173.443(a), Table 11	General Requirement: Non-fixed (removable) contamination must be kept as low as reasonably achievable (ALARA)	
	&( 0.4 Bq/cm <sup>2</sup> = 40 Bq/100 cm <sup>2</sup> = 1x10 <sup>-5</sup> Ci/cm <sup>2</sup> = 2200 dpm/100 cm <sup>2</sup>	
	" 0.04 Bq/cm <sup>2</sup> = 4 Bq/100 cm <sup>2</sup> = 1x10 <sup>-6</sup> Ci/cm <sup>2</sup> = 220 dpm/100 cm <sup>2</sup>	
The following exceptions and deviations from the above basic limits exist:		
Deviation from Basic Limits	Regulation 49 CFR §§	Applicable Location and Conditions Which must Be Met:
10 times the basic limits	173.443(b) and 173.443(c)  Also see 177.843 (highway)	On any external surface of a package in an <b>exclusive use shipment, during transport</b> including end of transport. Conditions include: (1) Contamination levels at beginning of transport must be below the basic limits. (2) Vehicle must not be returned to service until radiation level is shown to be ≤ 0.005 mSv/hr (0.5 mrem/hr) at any accessible surface, and there is no significant removable (non-fixed) contamination.
10 times the basic limits	173.443(d)  Also see 177.843 (highway)	On any external surface of a package, at the beginning or end of transport, if a closed transport vehicle is used, solely for transporting radioactive materials packages. Conditions include: (1) A survey of the interior surfaces of the empty vehicle must show that the radiation level at any point does not exceed 0.1 mSv/hr (10 mrem/hr) at the surface, or 0.02 mSv/hr (2 mrem/hr) at 1 meter (3.3 ft). (2) Exterior of vehicle must be conspicuously stenciled, " <b>For Radioactive Materials Use Only</b> " in letters at least 76 mm (3 inches) high, on both sides. (3) Vehicle must be kept closed except when loading and unloading.
100 times the basic limits	173.428	<b>Internal</b> contamination limit for <b>excepted package-empty packaging</b> , Class 7 (Radioactive) Material, shipped in accordance with 49 CFR 173.428. Conditions include: (1) The basic contamination limits (above) apply to <b>external</b> surfaces of package. (2) Radiation level must be ≤ 0.005 mSv/hr (0.5 mrem/hr) at any external surface. (3) Notice in §173.422(a)(4) must accompany shipment. (4) Package is in unimpaired condition & securely closed to prevent leakage. (5) Labels are removed, obliterated, or covered, and the "empty" label (§172.450) is affixed to the package.
In addition, <b>after any incident</b> involving spillage, breakage, or suspected contamination, the modal-specific DOT regulations (§177.861(a), highway; §174.750(a), railway; and §175.700(b), air) specify that vehicles, buildings, areas, or equipment have "no significant removable surface contamination," before being returned to service or routinely occupied. The carrier must also notify offer or at the earliest practicable moment after incident.		

## O. Straight Bill of Lading

Appendix 0

SAMPLE 1

## STRAIGHT BILL OF LADING

ORIGINAL—NOT NEGOTIABLE

Shipper No. \_\_\_\_\_

Carrier No. \_\_\_\_\_

Date \_\_\_\_\_

Page 1 of 1

(Name of carrier)

(SCAC)

TO: Metal Fabricators, Ltd. \*\*

Consignee

On Collect on Delivery shipments, the letters "COD" must appear before consignee's name or as otherwise provided in Item 400, Sec. 1.

FROM: Mo-Rad, Inc. \*\*

Shipper

Street 4321 Broad Street \*\*

Street 1234 Main Street\*\*

Destination Somewhere, USA

Zip Code 22222\*\*

Origin Anywhere, USA 20000\*\*

Route

Vehicle  
Number

No. of Units & Container Type	HM	BASIC DESCRIPTION Proper Shipping Name, Hazard Class Identification Number (UN or NA) per 172.101, 172.202, 172.203	TOTAL QUANTITY (Weight, Volume, Cubage, etc.)	WEIGHT (Subject to Conversion)	RATE	CHARGES (For Carrier Use Only)
1	RQ	Radioactive material, special form				
		n.o.s. UN2974 Class 7				
		1.9 TBq (50 Ci) Ir-192**	1.9TBq			
		Radioactive - Yellow II				
		TI = 0.4 **				
		USA/9033/B(U) Type B container				
		Emergency REspnse Telephone No.: 1-800-000-0000 (24 hr/d)**				
		**Substitute Appropriate Information for				
		Your Device and Your Shipment				

PLACARDS TENDERED: YES ☐ NO ☒REMIT  
C.O.D. TO:  
ADDRESS

Note: Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

\$ \_\_\_\_\_

I hereby declare that the contents of this document are fully and accurately described above by proper shipping name and are classified, packaged, marked and labeled, and are in all respects in proper condition for transport by rail, highway or water subject to applicable laws or regulations, according to applicable international and national governmental regulations.

Signature of Shipper

COD

Amt: \$

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other tender charges.

Signature of Consignee

C.O.D. FEE:

PREPAID ☐COLLECT ☐

TOTAL CHARGES: \$

FREIGHT CHARGES

Insured when rate of

Shipper's charge

is to be added

RECEIVED, subject to the classification and liability limit limits in effect on the date of the date of the Bill of Lading, the property described above in agreement with the shipper and the carrier and the condition of contents of packages, containers, marks, containers, and delivered as indicated above which and/or the carrier being understood throughout the contract as temporary receipt or acknowledgment of the property and/or the carrier's agreement to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination, it is mutually agreed as to each copy of all or any of, said property over all or any portion of

said route to destination and as to each party of any loss or damage to all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.

Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for transport and he assigns

SHIPPER

CARRIER

PER

PER

DATE

Permanent post-office address of shipper:

0-9

STYLE FB LABELMASTER, Div. of /maroon Labelmark Co., Chicago, IL 60646 312/478-0800

## P. Hazardous Material Shipping Certification

APPENDIX N

Sample 2

<b>HAZARDOUS MATERIAL SHIPPING CERTIFICATION</b>				
FOR COMPANY VEHICLE TRANSPORTING IRIIDIUM 192 SEALED SOURCES				
<b>SHIPPER*</b> Mo-Rad, Inc. 1234 Main Street Anywhere, USA 20000		<b>CONSIGNEE*</b> Mo-Rad, Inc. 1234 Main Street Anywhere, USA 20000		
<b>DATE*</b>		<b>NUMBER OF TERABEQUERELS (CURIES)</b>	<b>TRANSPORT* INDEX (MR/HR @ 39.37")</b>	<b>CERTIFYING* SIGNATURE</b>
5/01/98	Metal Fabricators 4321 Broad Street Somewhere, USA	1.9 (50)	0.4	John Jones
<b>DESCRIPTION OF PIECES AND CONTENTS</b>				
RQ RADIOACTIVE MATERIAL - SPECIAL FORM N.O.S. - UN 2974 - CLASS 7 IRIDIUM 192: 110 CURIES MAXIMUM TYPE B CONTAINER - YELLOW LABEL II - TRANSPORT INDEX NOT TO EXCEED 1.0				
AMERSHAM MODEL 660 SERIES <input type="checkbox"/> USA/9033/B(U)	AMERSHAM SHIP/CON MODEL 650L <input type="checkbox"/> USA/9269/B(U)	SPEC MODEL 150 <input type="checkbox"/> USA/9263/B(U)	SPEC SHIP/CON MODEL C-1 <input type="checkbox"/> USA/9036/B(U)	
<small>This is to certify that the above named materials are properly classified, described, packaged, marked, labeled and are in proper condition for transportation according to the applicable regulations of the DEPARTMENT OF TRANSPORTATION . (See certifying signature above)</small>				
<b>INSTRUCTIONS</b>				
<small>"Radioactive Yellow II Label" - 0.5 to 50 mR/hr on the surface of package and not over 1.0 mR/hr at 39.37" from container. Yellow II label does not require vehicle placards. NOTE: Do not transport if surface of container is over 50 mR/hr and/or over 1 mR/hr at 39.37" from container.</small>				
<small>Shipping papers must be within reach of the driver when wearing a seat belt. Should the driver leave the vehicle, the shipping papers are to be left on the front seat of the driver's side or in a box on the driver's side of the vehicle.</small>				
<small>If a motor vehicle accident occurs, it is required that an accident report be filed with the DOT within 15 days. Give no information regarding radioactive material to anyone present at the scene except police or DOT or NRC officials. Other information is to be obtained from the Radiation Safety Officer</small>				
<b>EMERGENCY TELEPHONE NUMBER - 1-800-000-0000</b>				

\* Substitute appropriate information for your device and shipment.

NUREG - 1556, Vol. 2

N-10

**Appendix O:**

**Daily Maintenance Check of Radiographic  
Equipment**

## Daily Maintenance Check of Radiographic Equipment

A. The radiographer or radiographer assistant shall perform a daily maintenance check of the exposure device and related radiographic equipment. This inspection will be performed before using the equipment on each day the equipment is to be used. Report defective equipment to the RSO immediately. Do not attempt to use defective equipment. After the inspection, document the results of the inspection.

1. Inspect the survey meter for battery check, zero and operation. If batteries are low, replace, then check for operability. If not able to correct a problem with the survey meter, obtain another meter and start over.
2. Check survey meter with a check source (which should give a reading of \_\_\_\_\_ millirem) (or check with camera \_\_\_\_\_ which should give a reading of \_\_\_\_\_ millirem) as indicated on the survey meter. If reading is not acceptable, obtain another meter and start again.

**Note:** RSO or calibration vendor should determine the acceptable meter reading for each survey meter and post the expected reading on each instrument. This reading shall be obtained and noted at the time of calibration.

3. Inspect the remote-control radiographic equipment as follows:
  - Inspect the cables for cuts, breaks, and broken fittings.
  - Carefully inspect approximately one foot of the drive cable immediately next to the male connector. Take care not to introduce any dirt or dust on the drive cable during this inspection. In addition to the previously mentioned items, the examination of the cable should look for any of the following:
    - excessive or uneven wearing;
    - fraying;
    - unraveling;
    - nicks;
    - kinks or bends;
    - loss of flexibility (abnormal stiffness);
    - excessive grit or dirt;
    - stretching;
    - Inspect the crank unit for damage and loose hardware;
    - Check operation of the control for freedom of drive cable movement;
    - Inspect the guide tube for cuts, crimps, and broken fittings;

- Survey for radiation levels and record readings. The radiation levels should be about the same as those in the previous day's inspection, unless there has been a source change;
- Check that all safety plugs are in place;
- Inspect the exposure device for damage to fittings, lock, fasteners, and labels; and
- Check for any impairment of the locking mechanism.

4. Record the results of the daily inspection.



**Appendix P:**  
**Suggested Example of a Routine Emergency  
Procedure**

## Emergency Procedure

If the source fails to return to the shielded position or if any other emergency or unusual situation arises (e.g., vehicle accident, off-scale dosimeter, etc.)

- Immediately secure the area and post the restricted area at the 0.02 mSv/hr (2 mrem/hr) radiation level; maintain continuous surveillance and restrict access to the restricted area.
- Notify the RSO and/or Management Personnel.
- Take no further actions until instructions are received from the RSO.
- Do not attempt source retrieval until the situation has been discussed with the RSO or other knowledgeable personnel.
- Don't panic. Source retrieval can be performed with very little exposure when properly planned by trained personnel.
- Notify the persons listed below of the situation, in the order shown.

Name*	Work Phone Number*	Home Phone Number*

\* Fill in with (and update, as needed) the names and telephone numbers of appropriate personnel (e.g., the Radiation Safety Officer (RSO), or other knowledgeable licensee staff , licensee's consultant, device manufacturer) to be contacted in case of emergency.

Follow the directions provided by the person contacted above.

## **RSO and Licensee Management**

Discuss emergency operating procedures, and ensure no operations are conducted until the situation has been discussed with and approved by the RSO or other knowledgeable staff, consultants, or device manufacture. Management should have access to emergency equipment to keep doses to radiographers as low as reasonably achievable. Emergency equipment may include high range dosimeters, extra lead shielding, remote tongs, etc.

Notify local authorities as well as DHFS as required. DHFS notification is required when sources or devices containing licensed material are lost or stolen and when radiographic sources or equipment are involved in incidents that may have cause or threatens to cause an exposure in excess of *HFS 157.32(2)* limits. Reports to DHFS must be made within the reporting time frames specified by *HFS 157.32*.

<b>Telephone notifications shall be made to DHFS at (608) 267-4797 during normal business hours (8 a.m. – 4:30 p.m.). DHFS’s 24 hour emergency telephone number is (608) 258-0099. Identify the emergency as radiological</b>
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